

A PICTORIAL SURVEY OF CURRENT PRACTICE, EQUIPMENT AND MATERIALS

Construction Methods

First Copy

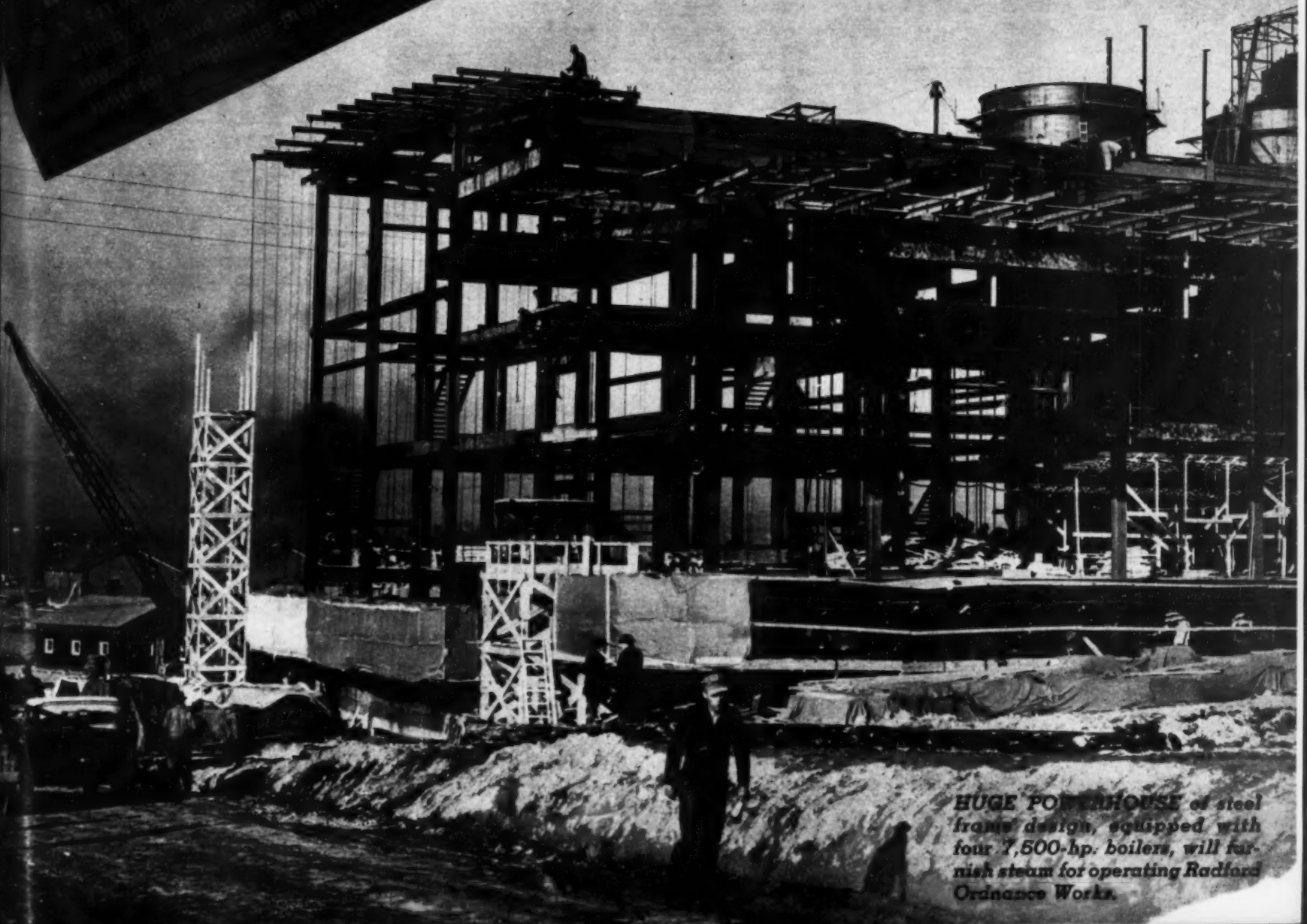
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DETROIT

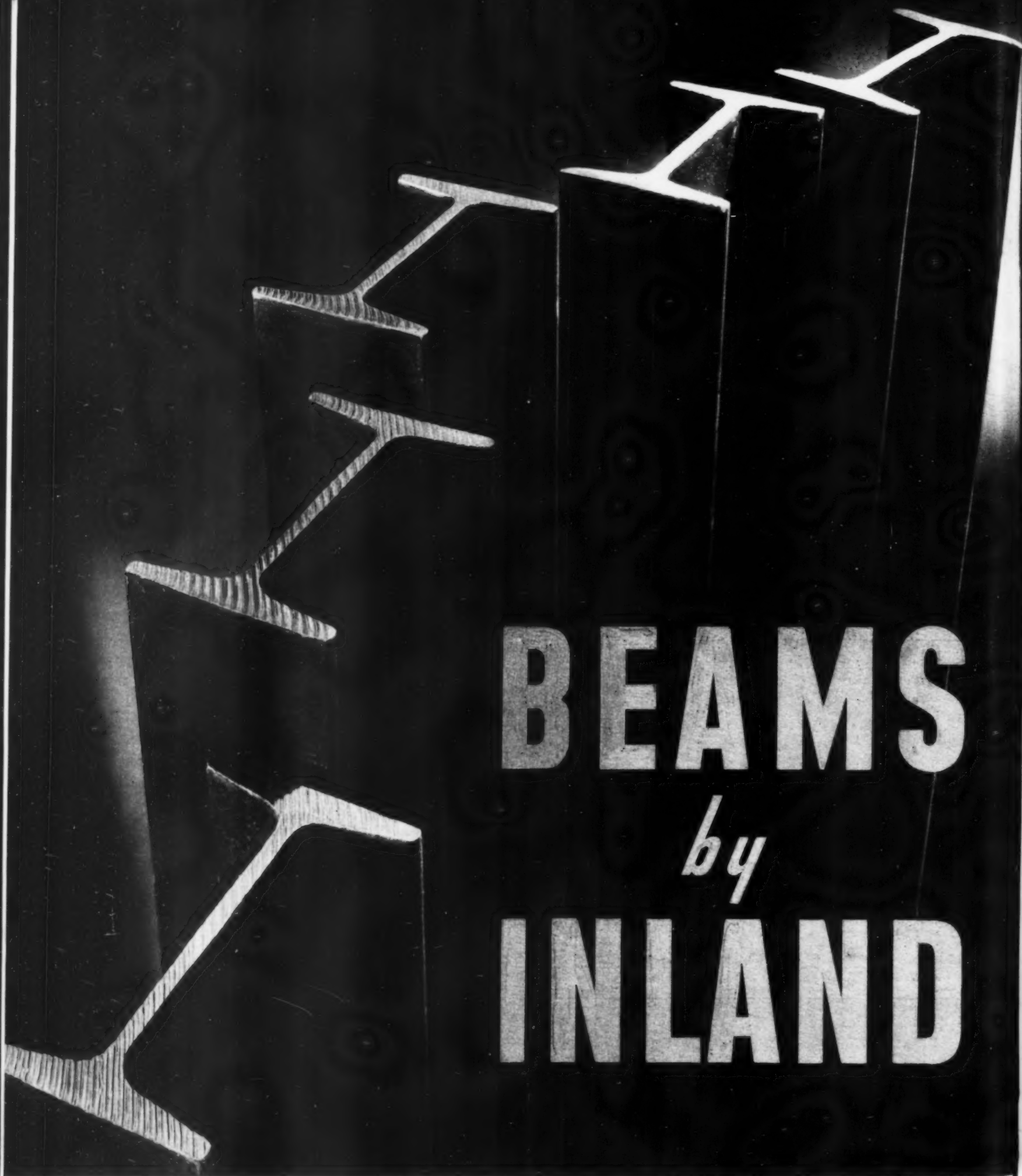
APRIL
1941

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THIS PICTURE
RADFORD ORDNANCE WORKS
A \$10,000,000 machine tool plant
which is now under construction
and will be completed in about
18 months.



HUGE POWERHOUSE of steel frame design, equipped with four 7,500-hp. boilers, will furnish steam for operating Radford Ordnance Works.



BEAMS

by

INLAND

TECHNOLOGY DEPT.

As a leading producer of Structural Steel and Steel Sheet Piling, Inland is in a position to cooperate closely on all construction projects.

Our engineers will work with you from the very beginning to the successful completion of the finished job.

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38 South Dearborn Street, Chicago

Sales Offices:

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Sheets • Strip • Tin Plate • Bars • Plates • Floor Plates
Structurals • Piling • Rails • Truck Accessories • Reinforcing Bars

CURRENT JOBS

.... and Who's Doing Them

BUILDINGS

Public—In Warren, Mich., **Bryant & Detwiler Co.**, of Detroit, will construct for the Hudson Motor Car Co. naval equipment plant for \$16,000,000. **Bridgeport Brass Co.**, of Bridgeport, Conn., received War Department contract to construct and equip plant for manufacture of cartridge cases in Indianapolis, Ind., for \$11,500,000, to be financed by Defense Plant Corp. Successful bidders for contract to build new Consolidated Aircraft Co. plant in Tulsa, Okla., were **Manhattan Construction Co.**, of Muskogee, and **Long Construction Co.**, of Kansas City, Mo., with price of \$10,476,400 on cost-plus-fixed-fee basis. **Austin Co.**, of Cleveland, Ohio, will build bomber assembly plant in Fort Worth, Tex., for Consolidated Aircraft Corp., at cost of \$10,000,000. In Sheffield, Ala., **F. H. McGraw Co.**, of New York, will construct for Reynolds Metal Co. aluminum rolling mill for \$10,000,000. Contract for bag-loading plant in Childersburg, Ala., was awarded to **Sullivan-Long & Hagerty**, local contractors, and **Algeron Blair**, of Montgomery, for \$9,456,816. **Walter Kidde Constructors, Inc.**, of New York, will erect brick and steel manufacturing building for crankcases for airplane engines in Harrison, N. J., for \$6,955,000, including equipment. In Mineral Wells, Tex., **Cage Bros.**, of Austin, and **F. M. Reeves & Son, Inc.**, of Bishop, were awarded contract to construct temporary housing facilities for 18,000 troops at Camp Walters for \$5,981,682 on cost-plus-fixed-fee basis.

In Ravenna, Ohio, **Hunkin-Conkey Construction Co.**, of Cleveland, will erect Army storage depot at cost of \$4,039,675. **American Brass Co.**, of Waterbury, Conn., will construct and equip plant for manufacture of ammunition brass and ammunition cups in Kenosha, Wis., for War Department, at cost of \$4,750,000, to be financed by Defense Plant Corp. Contract for housing facilities in Charleston, S. C., was awarded to **J. A. Jones Construction Co.**, of Charlotte, N. C., for \$3,924,607.

HEAVY CONSTRUCTION

Construction of drydock at Navy Yard, Philadelphia, Pa., is under way by **Drydock Associates**, of New York, for approximately \$8,000,000. In Bayonne, N. J., drydock and naval supply terminal are under construction by **George H. Flinn Corp.**, of New York City, and **Great Lakes Dredge & Dock Co.**, of Chicago, Ill., for \$10,000,000 and \$5,000,000 respectively. Contract for naval supply depot in Bayonne, N. J., was awarded to **Wigton-Abbott Corp.**, and **Mahony Troast Construction Co.**, of Plainfield, for \$3,000,000 on cost-plus-fixed-fee basis. **Geo. W. Rogers Construction Corp.**, of New York, will construct shipway and pier in Mariners Harbor, N. Y., for Bethlehem Steel Co., at an estimated cost of \$3,406,000. Contract for harbor defense, including heavy concrete construction at Cape Henlopen, Del., Ft. Saulsbury, Del., and Cape May, N. J., was awarded to **White Construction Co.**, of New York, and **George & Lynch, Inc.**, of Wilmington, Del., at price of \$3,500,000. **McWilliams Dredging Co.**, of Chicago, Ill., was low bidder for contract to dredge Cooper River Tail canal of Santee-Cooper project in South Carolina, at price of \$2,327,450.

HIGHWAYS AND BRIDGES

Among recent highway and bridge contract awards are the following: California: \$796,000 to **Radich & Brown**, of Burbank; Indiana: \$666,181 to **Thomas McQueen Co.**, of Forest Park; \$602,247 to **Calumet Paving Co.**, of Indianapolis; Kentucky: \$429,665 to **Allen-Codell Co.**, of Winchester; \$379,704 to **O. V. Arnett**, of Berea; \$239,131 to **F. J. Snider**, of Elizabethtown, and **Gorman Construction Co.**, of Flemingsburg; Minnesota: \$286,503 to **A. A. Bodin & Son**, of Duluth; \$304,939 to **Central States Construction Co.**, of Duluth, and **Whitmas & Borg**, of Bovey; North Carolina: \$746,953 to **Lowdermilk Bros.**, of Denver; Colo. Pennsylvania: \$318,785 to **A. Eidemiller**, of Greensburg; \$401,907 to **Tri-State Engineering Co.**, of Washington; South Carolina: \$322,170 to **Rober Lee, Inc.**, of Myrtle Beach; Tennessee: \$566,016 to **J. B. Michael & Co.**, of Memphis. In Washington, D. C., viaduct is under construction by **James McGraw Co.**, of Philadelphia, Pa., at cost of \$400,000. **Robinson & Steinman**, of New York City, will build two bridges in Bradenton, Fla., for \$1,500,000.

Federal Government Needs Engineers

A new examination for engineering positions in the Federal Government, paying from \$2,600 to \$5,600, is announced by the U. S. Civil Service Commission, Washington, D. C. Applications will be rated as received up to June 30, 1942. Further information and application forms may be obtained from the Commission or at any first or second-class post office. Duties include design, construction and research.

CONSTRUCTION METHODS, April, 1941. Volume 23. Number 4. Published Monthly. price 20¢ a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. **Subscription rates**—United States, Mexico and Central and South American countries, \$1.00 a year, \$1.50 for two years, \$2.00 for three years. Canada, \$1.50 a year, \$2.50 for two years, \$3.00 for three years. Great Britain and British Possessions 12 shillings a year, 36 shillings for three years. All other countries \$2.00 a year, \$6.00 for three years. Entered (or reentered) as second class matter December 16, 1936, at the Post Office at New York, N. Y., U. S. A., under the act of March 3rd, 1879. Printed in U. S. A. Cable address: "McGraw-Hill, New York." Member of A. B. P. Member of A. B. C. Contents copyrighted 1941 by McGraw-Hill Publishing Co., Inc., 330 West 42nd Street, New York, N. Y.

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JAMES H. McGRAW, Founder and Honorary Chairman

Editorial and Publishing Offices: 330 West 42nd St., New York; 520 North Michigan Ave., Chicago; 68 Post St., San Francisco; Aldwych House, London, W. C. 2, England. Branch Offices: Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

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APRIL, 1941

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Established 1919

McGraw-Hill Publishing Co., Inc.
330 West 42nd St., New York

Construction Methods

A Pictorial Survey of Current Practice, Equipment and Materials

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A. E. PAXTON, Manager

Editorial Staff: Vincent B. Smith, Paul Wooton (Washington)

N. A. Bowers (San Francisco) Nella Fitzgerald

A McGRAW-HILL PUBLICATION

The HOW of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

- How **\$41,000,000 POWDER PLANT** was built by 21,000 construction workers. —p. 42
- How **JOB MANAGEMENT** and labor supervision were organized on huge powder plant project. —p. 45
- How **DRINKING WATER** was supplied to construction workers by portable pressure fountains. —p. 47
- How **LOUD SPEAKERS** carried job announcements to workers on 4,000-acre project. —p. 47
- How **GIN POLE** and pick-up frame placed curved plates for steel tanks. —p. 48
- How **CONSTRUCTION EQUIPMENT** on big job was organized and operated to reduce idle time. —p. 50
- How **CANVAS HOUSING** protected concrete for filter beds during cold weather. —p. 52
- How **NIGHT WORK** was conducted with aid of portable flood-lighting plants. —p. 54
- How **PONTOON-MOUNTED CONVEYOR** belts carried stripped earth for disposal in pond. —p. 58
- How **TUNNEL CROSS-SECTIONS** were taken with mobile rig equipped with radial "feelers." —p. 58
- How **METAL FORM** served as template for positioning anchor bolts in concrete base of light standards. —p. 58
- How **CANTILEVER FORM PANELS** simplified pouring of concrete on big dam. —p. 59
- How **UNDERGROUND ELECTRIC CABLE** was laid by special tractor-hauled equipment. —p. 59
- How **GRAVEL AND BINDER SOIL** for stabilized road mix were prepared in drum of standard paving mixer. —p. 59
- How **ARMY BARRACKS BUILDINGS** were erected at rate of one every 54 minutes. —p. 60
- How **WOOD-WORKING MILL** prefabricated lumber for Army camp buildings. —p. 61
- How **BUILDING WALLS**, fabricated horizontally on ground, were up-ended by construction crew. —p. 62
- How **CRANES** erected towers for lift bridge. —p. 67
- How **CANVAS TENT** protected earth fill at canyon damsite. —p. 68
- How **"DWARF" PILEDRIVERS** worked inside buildings with 9½-ft. headroom. —p. 70

THE JOB JESTER

CARTOONS DRAWN FOR CONSTRUCTION METHODS



"This aid-to-Britain idea is all right, but I think the boss is overdoing it a bit by having tea served every afternoon."



"Oh, sorry! we thought this was a Blue Army machine-gun nest!"



"Sunday traffic? Doesn't bother me!"



'INCOR' WINS OPENING RACE AT BELMONT

**SPEEDS COLD-WEATHER ALTERATIONS
WITH MINIMUM PROTECTION . . .
FASTER CURING, BETTER CONCRETE**



WHEN New York State legalized pari-mutuel betting, Belmont Park, often called "the finest race-track in America," had to be streamlined in a hurry. By using 'Incor' 24-Hour Cement, extensive alterations were completed in dead of winter, under difficult job conditions. To illustrate:

Eighteen thousand sq. ft. of new 'Incor' concrete flooring was placed in the 3-tiered grandstand. Open to biting Long Island winds, with adequate protection next to impossible, concreting went ahead steadily, even at sub-freezing temperatures. Estabrook Construction Co., Hempstead, L. I., concrete contractor, maintained normal schedules straight through the winter, assuring on-time completion for season's opening.

Use 'Incor'* for top-speed construction at minimum cost. Write for copy of "Cutting Concrete Costs." Lone Star Cement Corporation, Room 2264, 342 Madison Avenue, New York.

*Reg. U. S. Pat. Off.

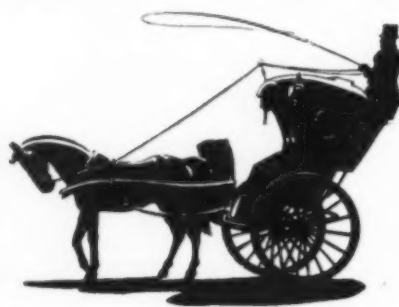
LONE STAR CEMENT CORPORATION
MAKERS OF LONE STAR CEMENT . . . 'INCOR' 24-HOUR CEMENT

ATLAS MANASITE DETONATORS

*Another
"ATLAS FIRST"*

Some People always question Progress

FROM the steamboat to the stratoliner...from the pony express to the radio...progress has never gone unquestioned. People scoffed at Fulton, they laughed at Edison.



them, blasters like the dependability of Atlas Manasite Detonators. Re-orders and new orders tell

the story—over 100,000,000 already have been used.

Atlas Manasite Detonators—a great step forward in safer blasting—have been no exception. Some people at first hesitated to use them. Yet—more and more blasters are using Atlas Manasite Detonators. Once they try

Atlas Manasite Detonators offer an increased margin of safety... with no sacrifice in detonating efficiency, and at no increase in cost. Safety precautions become, not less important, but more effective.

Are you using this advance in greater safety?

ATLAS

EXPLOSIVES
"Everything for Blasting"

CHEMICALS
ATLAS
EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington, Del. • Offices in principal cities • Cable Address—Atpowco



IDEAL FOR AIRPORT,
road, levee, and canton-
ment construction . . .

The smallest Euclid is a

BIG EARTH HAULER

OUTSTANDING LEADER
in the whole field of
small earth haulers . . .



It's BIGGER!

14 TONS
payload
capacity

9 CU. YDS.
struck
measure

12 CU. YDS.
crowned
load

It's FASTER!

Five speeds forward . . .
2 to 25 M. P. H. fully loaded.

It's MORE POWERFUL!

112 H. P.
gasoline
engine

OR

107 H. P.
diesel
engine

It's TIME-TESTED!

Many years of proven superiority! . . . Infinitely
more hours of profit-making performance!
Used and approved by many more contractors!

Descriptive literature showing exclusive
Euclid features will be mailed on request.

THE EUCLID ROAD MACHINERY CO.
CLEVELAND, OHIO

EUCLID

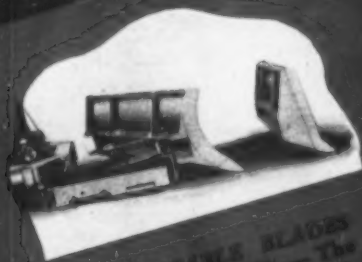
SELF-POWERED
EARTH • ROCK • COAL • ORE
HAULING EQUIPMENT

And—CRAWLER WAGONS • ROTARY SCRAPERS • TAMPING ROLLERS



ANNOUNCING

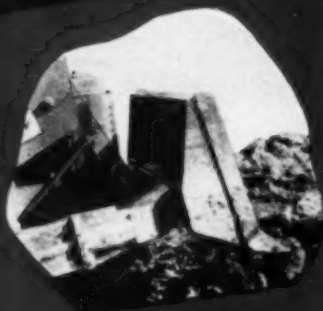
Cable Controlled BUCKEYE "UNITILT"



INTERCHANGEABLE BLADES ON UNITILT FRAME — The Buckeye UNITILT frame is universal for Buckeye blades. Changing from Bulldozer to Trailbuilder blade or vice-versa is quickly done by one man pulling two hinges. Tilting of the blade requires the adjustment of the frame of one bolt only to raise or lower at either end. The only interchangeable unit that will fit a Bulldozer blade!



BLADE ROLLS THE DIRT — Rolling action of blade enables operator to take deeper cuts because the lead is rolled up ahead and not pushed ahead — no dead weight — less power required — bigger "payloads" — moves faster — less strain on tractor — blade digs its own way in — no cylinders needed for down pressure.



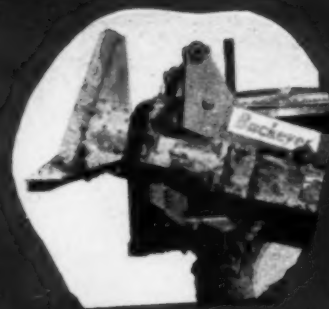
BLADES HUG FRONT OF TRACTOR — Bulldozer and Trailbuilder blades hang close to radiator, greatly reducing lead and wear on front idlers and track rolls. Note rigid, close-coupled construction.



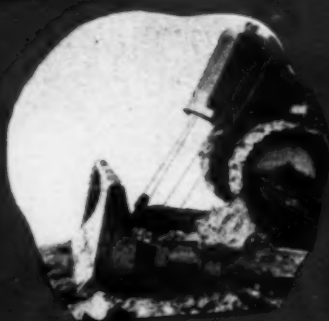
TRAILBUILDER EASILY ANGLED — It's a simple operation to install the extension to either side arm to angle the blade either way. A second member is also installed to give great rigidity.



BULLDOZERS and TRAILBUILDERS!



FULL FLOATING BLADE—Blade arms pivot at drive end of tractor — free-swinging action up or down for high lift and deep bite of blade. Buckeye cable control gives tremendous power and lightning-fast action!



BALANCED TO UTILIZE FULL TRACTOR POWER—Full lengths of crawlers stay on the ground — no lost traction — maximum pushing power secured — mechanical downward pressure not required — no cylinders for pushing blade down and tipping tractor up.

PUSHING POWER APPLIED CLOSER TO CUTTING EDGE!

Use
EITHER BLADE
on the
same frame

THE new Buckeye UNITILT design brings you long-awaited improvements in Bulldozer and Trailbuilder construction: You buy *only one* universal frame — use it with all Buckeye Blades! • You get Buckeye's patented tilting device which lets the operator quickly tilt his blade the way he wants it and keep it there! • You reduce the heavy overhanging load on the front of your tractor because the blades are hung so they "hug" the radiator! • You get more out of your tractor because Buckeye *balance* keeps the full lengths of the crawlers *on the ground*! • You get a

rigid, rugged frame that will take the battering of the toughest bulldozing without a whimper! • You get Cable Control at its best with Buckeye Power Control Units — smooth, fast action with no jerk on the line, greater lifting power, simplicity and freedom from trouble!

In short, Buckeye UNITILT Bulldozers and Trailbuilders are rarin', tearin', brutes for punishment that'll move *more yardage per day*, push bigger payloads and give you bigger profits on any job! Don't wait to put this up-to-the-minute equipment on your tractors. Write to Buckeye today!

BUCKEYE TRACTION DITCHER COMPANY

Findlay, Ohio

Built by **Buckeye** ✓

Convertible Shovels



Trailbuilders



Tractor Equipment



R-B Finegraders



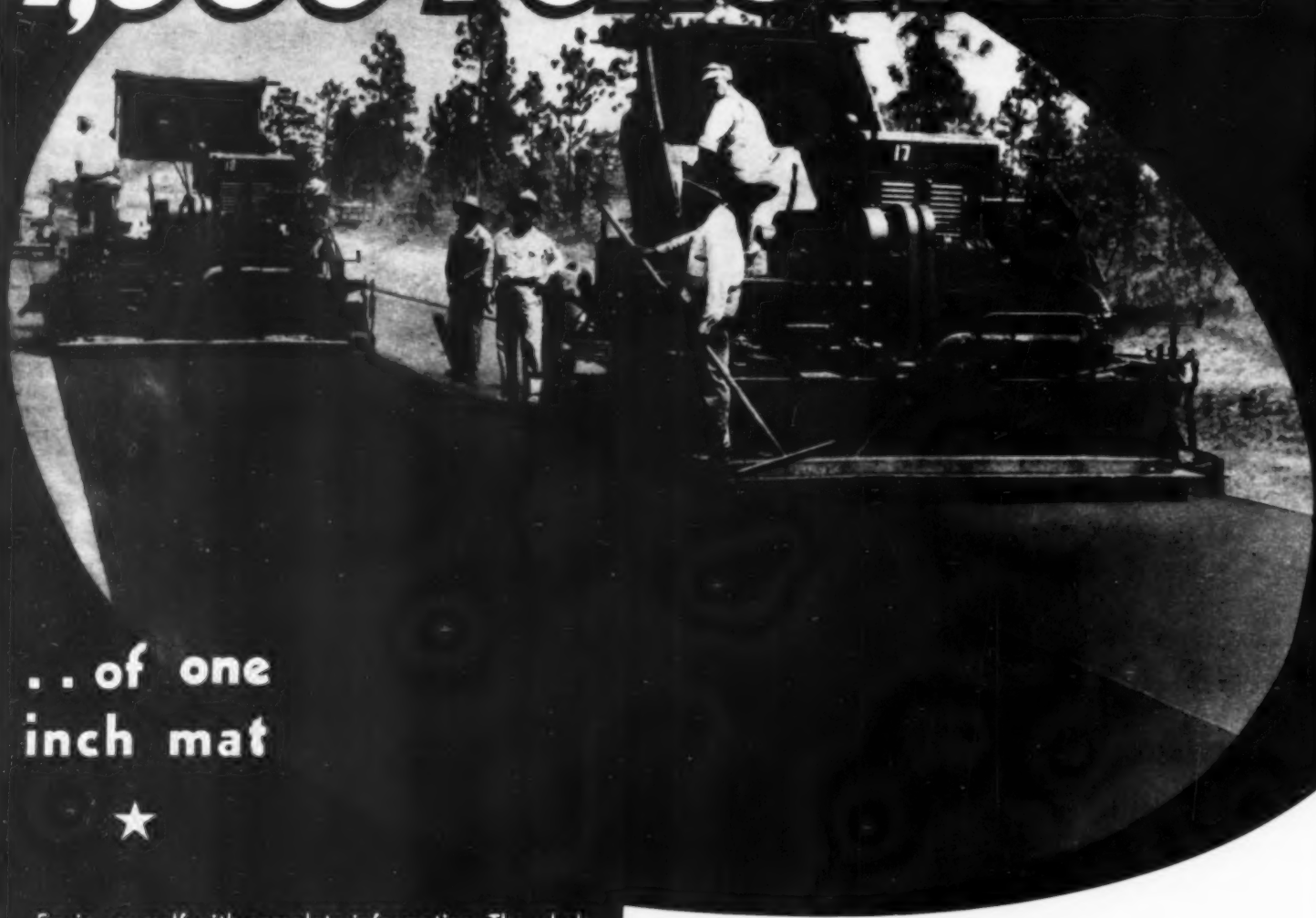
Road Wideners



Spreaders



AVERAGING 1,000 TONS A DAY



.. of one
inch mat



Equip yourself with complete information. The whole story is in the Barber-Greene Finisher Booklet. Send a card or letter for your copy. There is no obligation.



IT takes systematic organization to lay 1,000 tons of 1" x 22' mat any day. But to average 1,000 tons a day for 31 miles of the most beautiful sand asphalt you have ever seen, perfectly leveled, and uniformly compacted, takes more than organization and good intentions—it takes Barber-Greene Tamping-Leveling Finishers.

The State of Georgia is using two of its Barber-Greenses on this two course job from Jesup to Nahunta, not only proving the excellence of Barber-Greene pavement and the economy of B-G operation, but the way in which Barber-Greenses set the pace for the whole project.

40-13

BARBER
AURORA



GREENE
ILLINOIS

Your "GREEN LIGHT" to Greater Profit in '41 . . .



You travel on a continuous "green light" to profits when you use Worthington Rock Drills, Air Tools and Portable Compressors. You subtract from your expenses and add to your earnings when you take advantage of the cost-cutting

features offered by Worthington equipment. Climb on the bandwagon with the ever-increasing number of contractors and maintenance men who are traveling the "MORE WORTHINGTON IN '41" non-stop highway to Greater Profit in '41!

Worthington Features that say "GO":

ROCK DRILLS AND AIR TOOLS

DESIGN: Skilled, scientific designing results in low air consumption, high rate of penetration—and a tool that is easy on the operator.

QUALITY: Forged steel throughout, precision-made parts, and highest skilled workmanship guarantee ruggedness, long life and low maintenance.

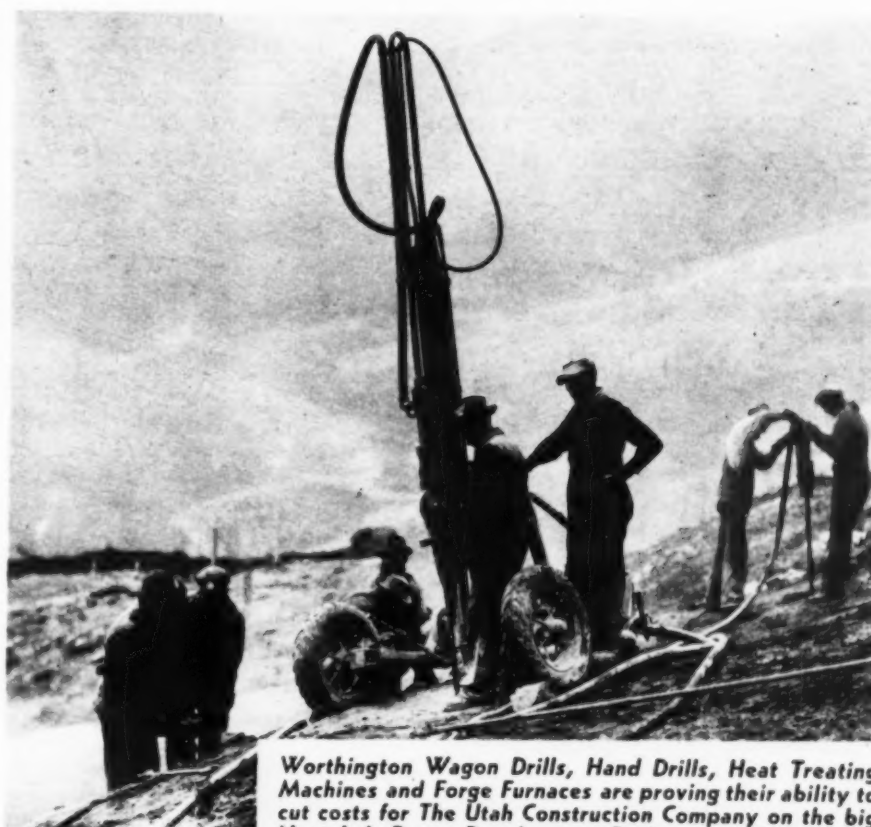
SPECIAL FEATURES: In certain Drifters and Hand-Held Drills such exclusive Features as Independent Rotation, Pneumatic Feed and Hole Spotters result in lower cost per foot of rock drilled.

PORTABLE AND SEMI-PORTABLE COMPRESSORS

Worthington Compressors are designed for heavy-duty, low-speed service resulting in maximum overall performance with long life and low maintenance cost. These benefits result from—

- TWO STAGE AIR COOLING
- FEATHER VALVE
- ARTICULATED CONNECTING ROD
- FORCE FEED LUBRICATION
- ENCLOSED CLUTCH
- SEALED CRANK CASE
- UNIT ASSEMBLY
- SIX-CYLINDER ENGINE
- SECTIONALIZED RADIATOR AND INTERCOOLER
- STRUCTURAL STEEL ALL-WELDED FRAME
- ROLLER BEARING WHEELS

There is a Worthington Distributor or Branch Office in your area that will give you prompt local service.



Worthington Wagon Drills, Hand Drills, Heat Treating Machines and Forge Furnaces are proving their ability to cut costs for The Utah Construction Company on the big Nantahala Power Development Project in Andrews, N. C.

WORTHINGTON



WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.

HOLYOKE COMPRESSOR AND AIR TOOL DEPARTMENT
HOLYOKE, MASSACHUSETTS

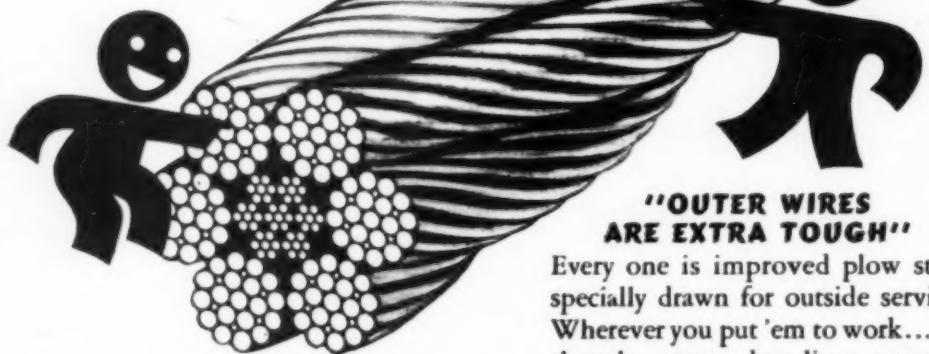
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Thanks to TWO KINDS OF WIRE IN MONARCH PREFORMED

...You Buy LESS Rope...You Use It LONGER
...You Have FEWER Shutdowns

"INNER WIRES ARE EXTREMELY FLEXIBLE"

They are improved plow steel. They're drawn in a special way to make them extra strong and EXTREMELY PLIABLE. They bend over sheaves and drums easily, constantly ward off internal fatigue. These wires in Monarch Whyte Strand give the rope great reserve strength, long life.



"OUTER WIRES ARE EXTRA TOUGH"

Every one is improved plow steel specially drawn for outside service. Wherever you put 'em to work...on shovels, cranes, drag-lines, scrapers...THESE wires can take it. They're the rope's first line of defense against corrosion, abuse and abrasion. They won't give up quickly.

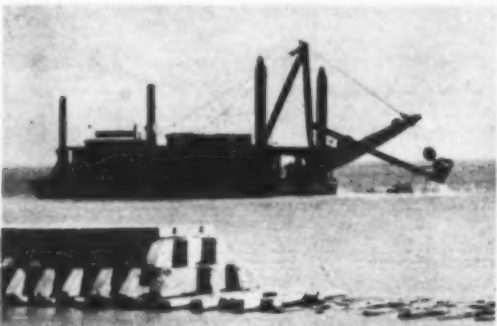
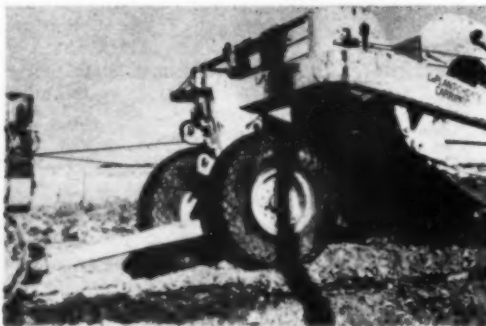
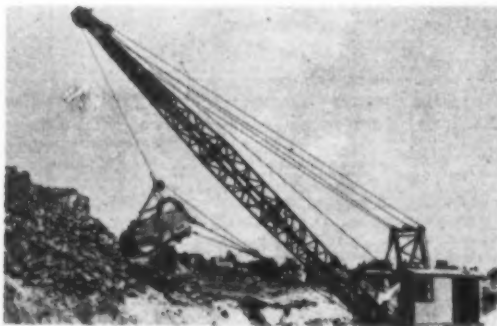
Then, between and around every wire, is a specially formulated Macwhyte lubricant that guards those unseen, inside wires. No bearing surface is left uncovered. All are cushioned against abrasion, friction and corrosion by the finest lubricant available. Ask your distributor about Monarch Whyte Strand PREformed.

MACWHYTE COMPANY

2941 Fourteenth Ave., Kenosha, Wisconsin
Manufacturers of rope wire—left-&-right lay braided slings—Stainless Steel wire rope—Aircraft cable, Aircraft tie rods, and "Safe-Lock" Swaged Terminals—and wire rope to meet every need.

New York • Chicago • Pittsburgh • Ft. Worth
Portland • Seattle • San Francisco

Distributors throughout the U. S. A.



MACWHYTE EXCAVATOR ROPES

The correct ropes for your equipment

PRE-FORMED FOR BEST PERFORMANCE



A New Wheel Bearing Lubricant

That doesn't leak out!

ONLY A YEAR AGO, conditions like those shown at the right would have been highly improbable. Today, these photos show a situation rapidly becoming commonplace where the new **TEXACO MARFAK-HEAVY DUTY** is in use.

Note the generous amount of lubricant still on the rollers and in the hub . . . after 34,000 miles of operation in the cold of northern winter and the heat of summer.

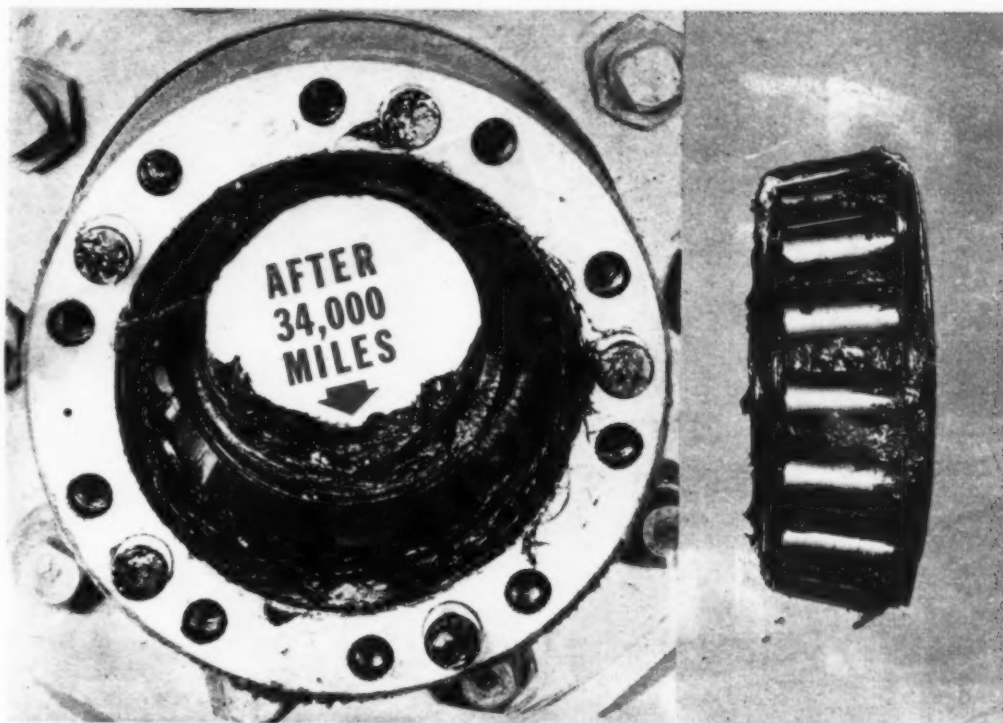
For the first time in automotive history *no seasonal changes are required in any climate.*

The resistance of *Texaco Marfak-Heavy Duty* to high temperatures and its fluidity at very low temperatures are accomplishments resulting from Texaco's research. Its use assures prolonged wheel bearing life in heavy duty automotive service.

The outstanding performance that has made Texaco preferred in the transportation field has also made it preferred in the fields as listed to the right.

Buyers in these fields are enjoying many benefits. You, too, will find important advantages when you use Texaco Lubricants and Fuels. Let a Texaco Lubrication Engineer cooperate in reducing maintenance costs in your equipment. Phone the nearest of more than 2300 Texaco distributing plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, N. Y., N. Y.



- ★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.
- ★ More railroad rolling equipment in the U. S. is lubricated with Texaco than with any other brand.
- ★ More tourists use Texaco Fire-Chief Gasoline than any other brand.
- ★ More scheduled airline mileage within the U. S. and to other countries is flown with Texaco than with any other brand.
- ★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.
- ★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.



Texaco Dealers invite you to enjoy FRED ALLEN in a full-hour program every Wednesday night. CBS, 9:00 E.S.T., 8:00 C.S.T., 10:00 M.S.T., 9:00 P.S.T.

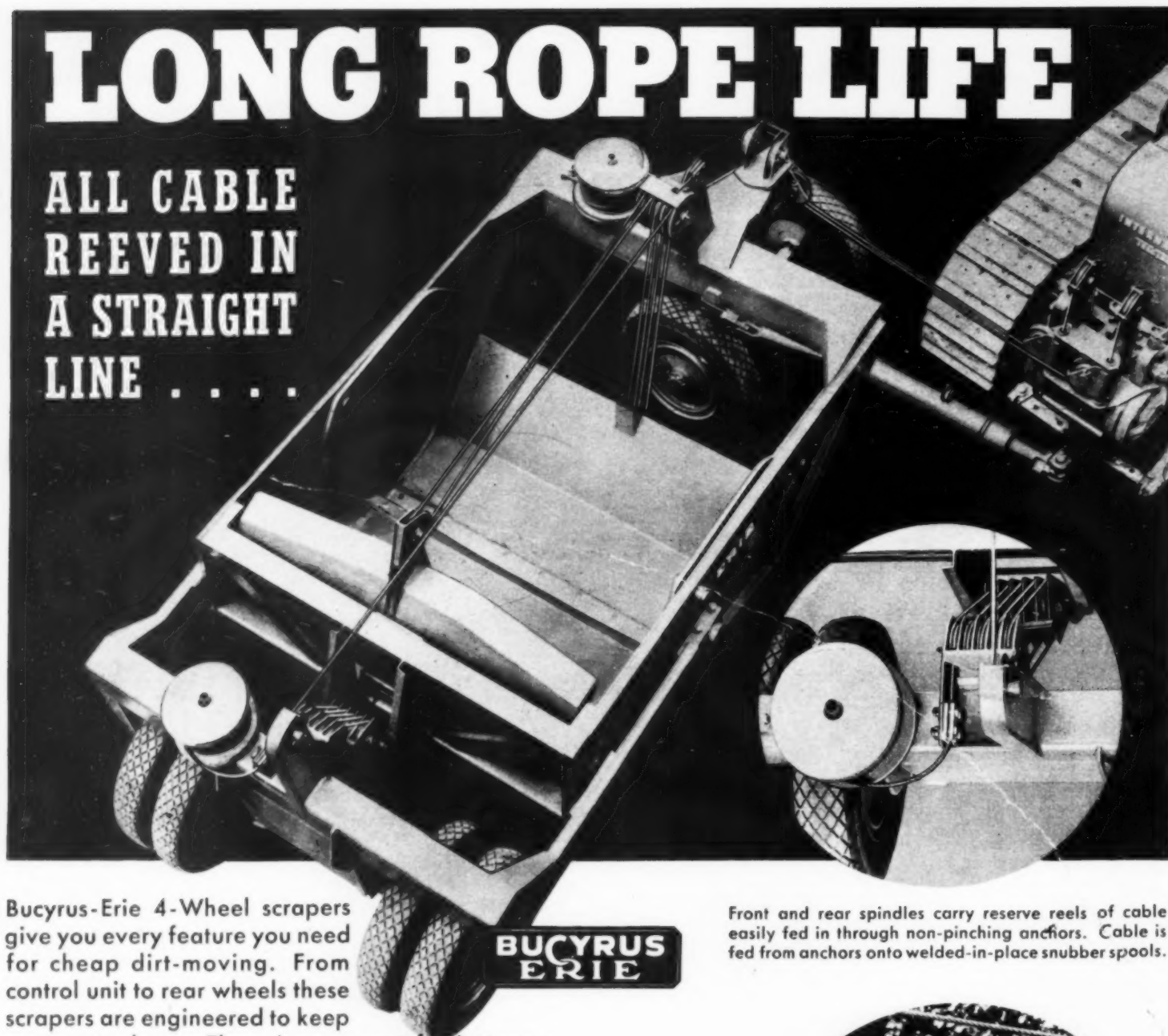


TEXACO Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

LONG ROPE LIFE

ALL CABLE
REEVED IN
A STRAIGHT
LINE



Bucyrus-Erie 4-Wheel scrapers give you every feature you need for cheap dirt-moving. From control unit to rear wheels these scrapers are engineered to keep your costs down. There is rope cost for instance:

All cable is reeved so that there are no side bends, no damaging twists, and only a minimum number of reverse bends.

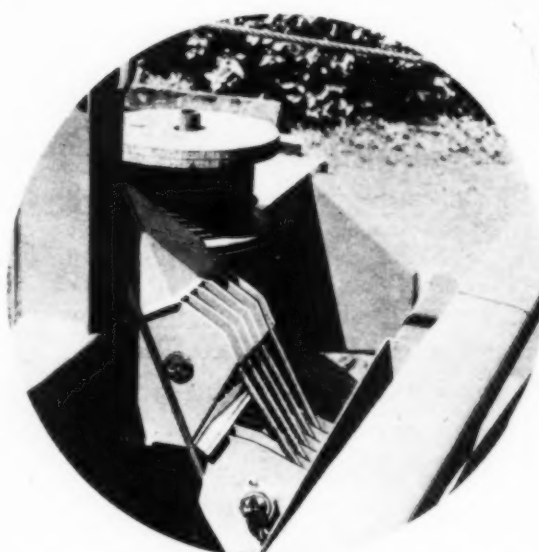
The sheaves are big; they're all vertical with horizontal axes; they're mounted on easy-rolling anti-friction bearings; on each model they're all the same size and interchangeable.

Self-aligning fairleads on scraper and control unit prevent fouling between the unit and scraper and eliminate lateral or vertical cable distortion.

Wear occurs within a few feet of the control unit, where the cable is easy to watch, and where worn cable can be easily and economically removed.

Bucyrus-Erie 4-Wheel scrapers are easy on cable and keep rope costs low. This is one of many ways in which they will increase your dirt-moving profits. Get the complete story from your International TracTracTor distributor.

Front and rear spindles carry reserve reels of cable easily fed in through non-pinching anchors. Cable is fed from anchors onto welded-in-place snubber spools.

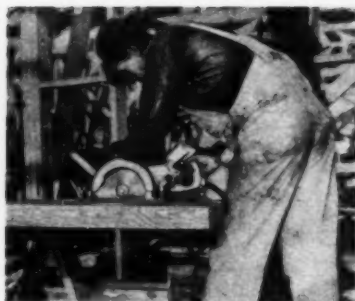


A friction cushion between the rear tackle blocks provides for a slight overrun of the cable after the blocks are in contact, eliminating shock strains in the cable resulting from block to block contact.

Bucyrus-Erie
S O U T H M I L W A U K E E , W I S C O N S I N



INSULATION MATERIAL being cut to size right on the job with the famous B & D Electric Quick Saw. One of the many ways the No. 85 Saw helps trim operating costs.



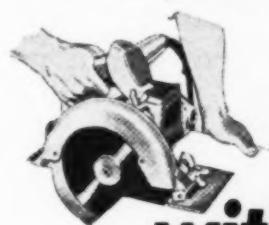
ON HEAVY CONSTRUCTION JOBS where extra deep cutting is required, the powerful B & D No. 95 Saw has ample power to cut through toughest structural lumber.



FAST, CLEAN CUTS IN STONE made easy by this husky No. 95 Black & Decker Saw and abrasive disc. This larger unit has extra depth of cut for heavy sawing work.



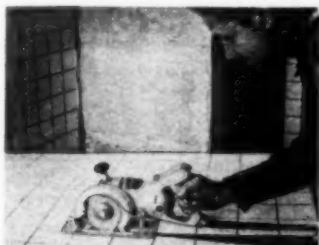
SAWING FORM LUMBER for concrete foundations or other construction purposes is a fast operation with Black & Decker's powerful No. 85 Portable Electric Quick Saw.



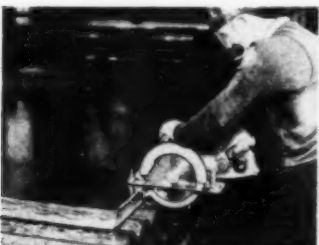
Speed Up your Building Program with Black & Decker Electric Saws



EASY, ONE-HAND OPERATION — cutting off gable end of porch with powerful B & D No. 85 Quick Saw. Cuts structural lumber faster and better with minimum fatigue.



TRIMMING TILE-BOARD to size—one of the many ways builders are speeding up jobs with Black & Decker Saws. Small, light model B & D Saw is easier to handle on trim work.



SHEET LEAD BEING CUT with No. 95 Black & Decker Saw—an example of the many industrial applications of these Saws in cutting both iron base and non-ferrous metals.



CARRY THIS "SAW-MILL" to the job! Black & Decker Electric Saws mounted on handy Portable Saw Tables convert the units into super-speed, stationary Saws. They're real time savers on the job.

TEN TIMES FASTER THAN HAND SAWING, Black & Decker Portable Electric Saws are saving valuable hours today on national defense projects, home building, and industrial construction. Models are available to fit any sawing job, plug into any electric socket or portable generator, cut almost any material. All Black & Decker Saws have safe, telescoping blade guards and easy adjustments for depth and angle of cut. Write for your copy of the free "Saw Handbook" described below.



SAWING STAIR STRINGERS with Black & Decker No. 85 Electric Saw. One of dozens of building operations this fast Saw performs in a fraction of time required by hand. B & D also has a complete line of saw blades.



NO JOB TOO TOUGH! Illustration shows a B & D Saw fitted with abrasive disc, cutting corrugated asbestos-cement material smoothly, quickly and accurately.

Black & Decker Saws help push Defense Construction by serving on projects from coast-to-coast to put new speed in all building operations. Shown here is a No. 85 Black & Decker Electric Saw cutting stair stringers in a fraction of usual time.

Send for Free "SAW HANDBOOK"

Illustrated 28-page book shows the construction, operation and wide applications of Black & Decker Saws and Accessories. This "Saw Handbook" points out many new time-and-money-saving ways Electric Saws help speed up jobs. Write for your Free Copy today! The Black & Decker Mfg. Co., 759 Pennsylvania Ave., Towson, Md.

"ELECTRIC TOOL HEADQUARTERS"

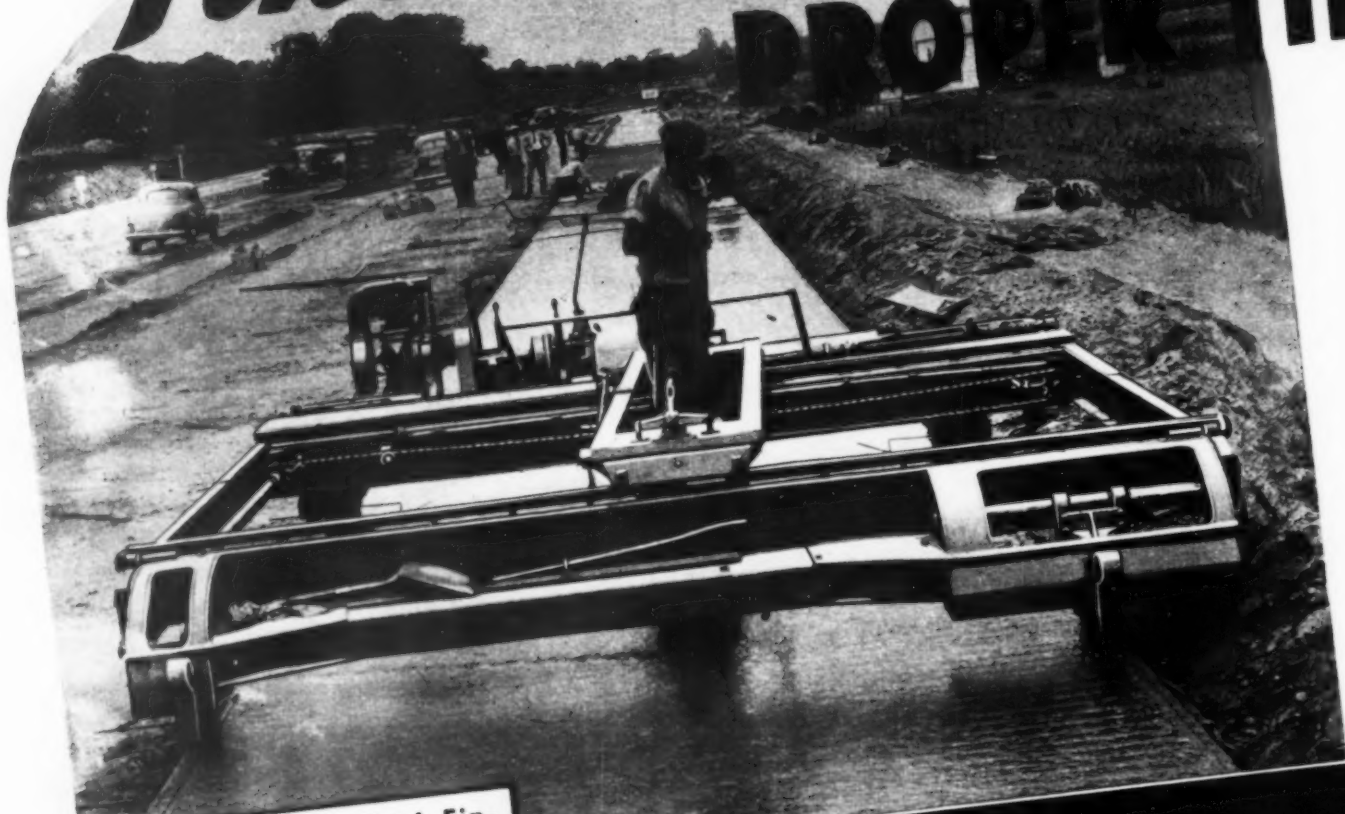


LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

**PORTABLE
ELECTRIC TOOLS**

Finish Slab at PROPER TIME

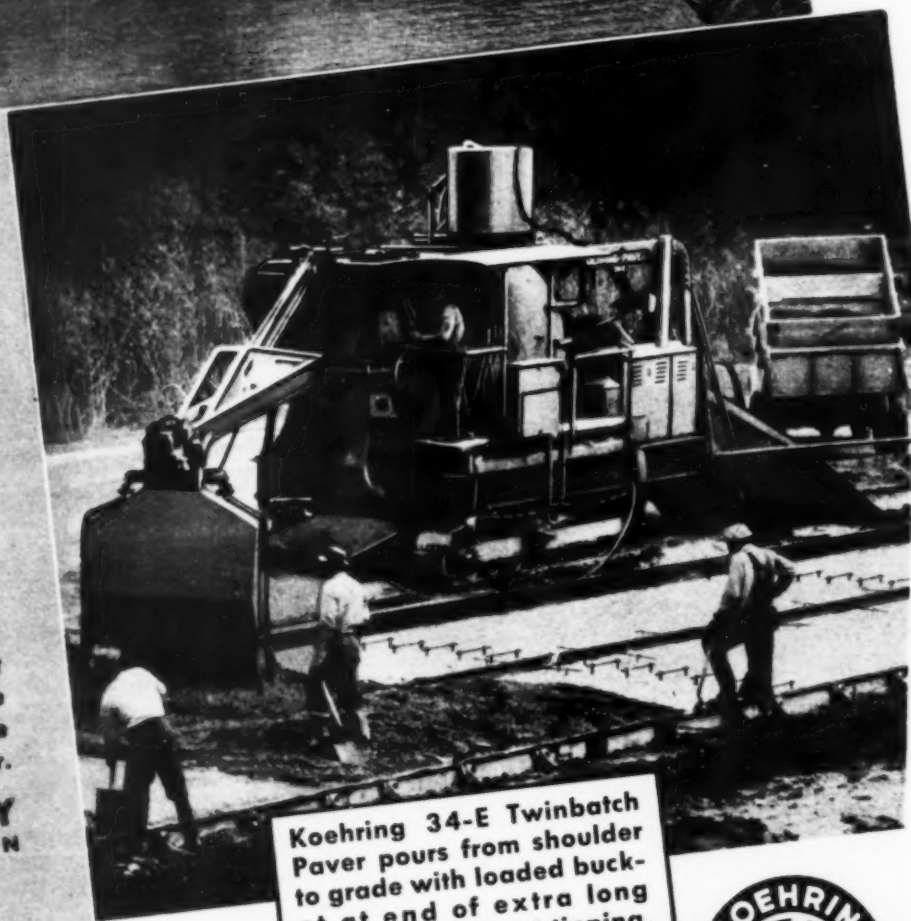


Koehring Longitudinal Finisher available for half-width and full width pavements.

The Koehring Longitudinal Finisher can operate on the slab after the initial set and slump has taken place . . . the proper time to finish the slab for best results.

Hand finishing after the initial set is difficult and sometimes impossible . . . surface inaccuracies are usually not easily corrected by hand. Mechanical finishing with the longitudinal Finisher assures specification accuracy, permits finishing at the proper time, finishes slab at any speed. Paving contractors save dollars and worry when using the Koehring Longitudinal Finisher.


KOEHRING COMPANY
MILWAUKEE • WISCONSIN



Koehring 34-E Twinbatch Paver pours from shoulder to grade with loaded bucket at end of extra long boom . . . without tipping.



HEAVY-DUTY CONSTRUCTION EQUIPMENT



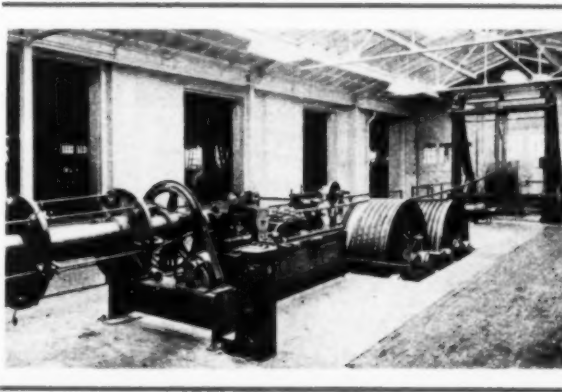
To Serve You Better—

**We Have Installed This Up-to-the-Minute Machine
— for Making —
"HERCULES" (Red Strand) WIRE ROPE**

Reg. U. S. Pat. Off.

WHILE all wire rope making equipment in our plant is constantly kept at top efficiency... while new machines are added from time to time... while improved methods are continually being developed, we have installed this giant wire rope "closer" in order to serve you better at this critical time when the words "Quality" and "Service" take on added importance.

This new machine is the result—the culmination—of diligent research and long practical experience in designing, building and operating wire rope making machinery to meet definite and predetermined requirements... machinery capable of performing specific operations accurate-



ly and efficiently. Its design is such that, automatically, there is precise control of every stage in the closing operation. It is another Leschen example of where nothing is left to chance.

Our endeavor to serve you better is in keeping with one of our fundamental policies that "Leschen Quality" and "Leschen Service" must continually move

forward. In the ever advancing march of progress there is no place to stop and rest upon past accomplishments or past laurels. Because of our strict adherence to this policy, you can always depend on "HERCULES" (Red-Strand) Wire Rope for top-flight performance.

MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

WIRE ROPE MAKERS

5909 KENNERLY AVENUE

ESTABLISHED 1857

ST. LOUIS, MISSOURI, U. S. A.

NEW YORK / / / **90 West Street**

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PORTLAND / / / **914 N. W. 14th Avenue**

SEATTLE / / / **3410 First Avenue South**



THERE'S A

DIFFERENCE

IN DIESEL
ECONOMY!

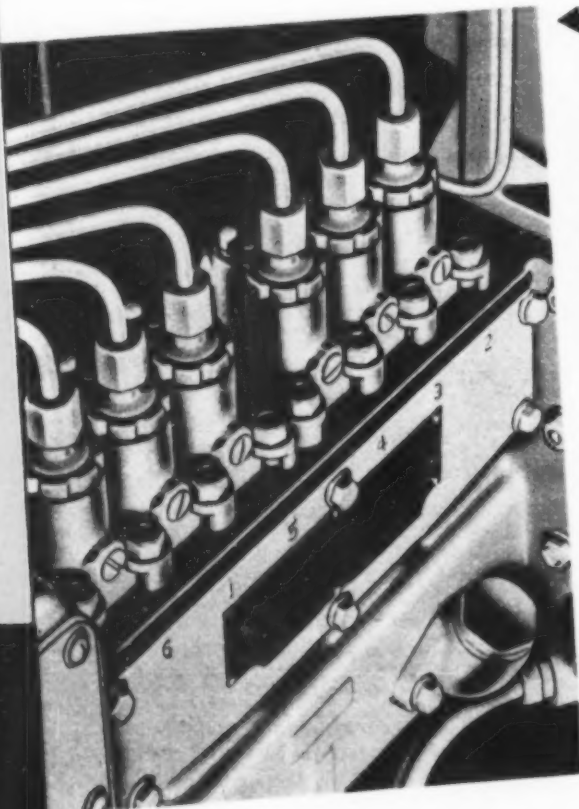
EVERYBODY knows that the Diesel engine costs you less to run. The big thing, though, is this: A "CATERPILLAR" DIESEL CAN SAVE YOU MORE THAN THE USUAL DIESEL!

This is because "Caterpillar's" exclusive fuel-system—and the method of fuel-injection and pre-combustion of fuel—permits you to run on such lower cost fuel as No. 3 furnace oil generally used for household oil burners!

The average cost of such fuel is about 2c and more a gallon *below* that of the usual "high-speed" Diesel fuel. In 10,000 hours of operation, therefore,

a 100-horsepower "Caterpillar" Diesel can give you *all* the ordinary Diesel savings—with an *additional saving* of about ONE THOUSAND DOLLARS!

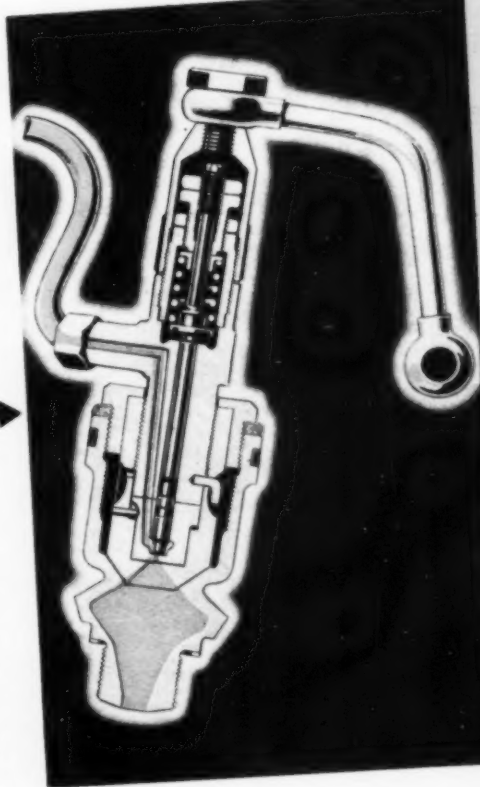
This is one example of the dollar-and-cents difference between Diesel economy and "Caterpillar" Diesel economy. Other sizes of "Caterpillar" Diesels effect these additional savings in proportion to their horsepower and their fuel-consumption per hour. Write us about your work and its requirements—and let us estimate the difference a "Caterpillar" Diesel can make in the amount you spend for power!



← **HERE IS ONE IMPORTANT DIFFERENCE**
Inside the housing shown here is the exclusive "Caterpillar" Diesel fuel-system. Individual pumps supply fuel to each cylinder. *No mechanical field adjustments are ever necessary!* These pumps are interchangeable and easily replaceable—made of high-quality material selectively hardened for maximum wear and machined to a perfection of fit unexcelled in the Diesel industry. Designed and built by "Caterpillar," these pumps are serviced by "Caterpillar" dealers in any locality. The simplicity, long life and trouble-free performance of this assembly is proof that *there is a difference in Diesel economy!*

MORE MONEY SAVED HERE!

Follow the yellow line from upper left downward. "Caterpillar" pumps supply fuel under pressure to the injection valve which automatically unseats to shoot an atomized spray of fuel into the cylinder. No mechanical operating adjustments here, either, and another "Caterpillar" precision-built assembly. The design of the injection valve assures continuous conditioning of even the heavier, lower cost fuels which are further prepared for combustion by the pre-combustion chamber. In this chamber (shown below valve) the spray of fuel is changed into a hot swirling gas which passes into the cylinder where additional air completes combustion and the power stroke.

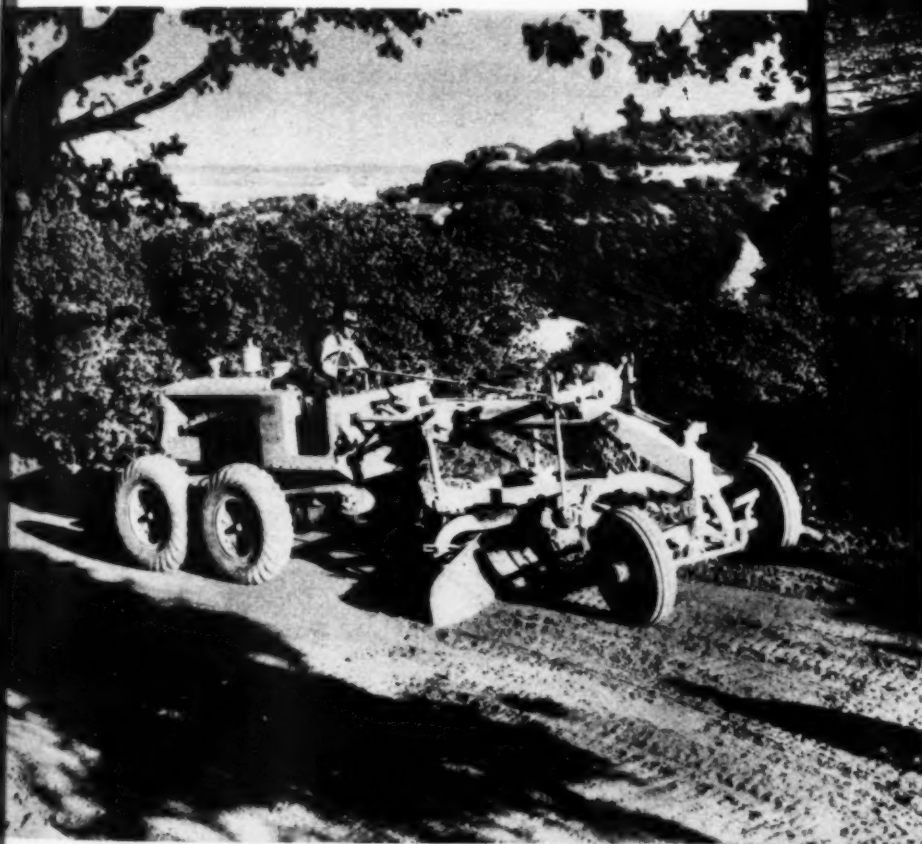
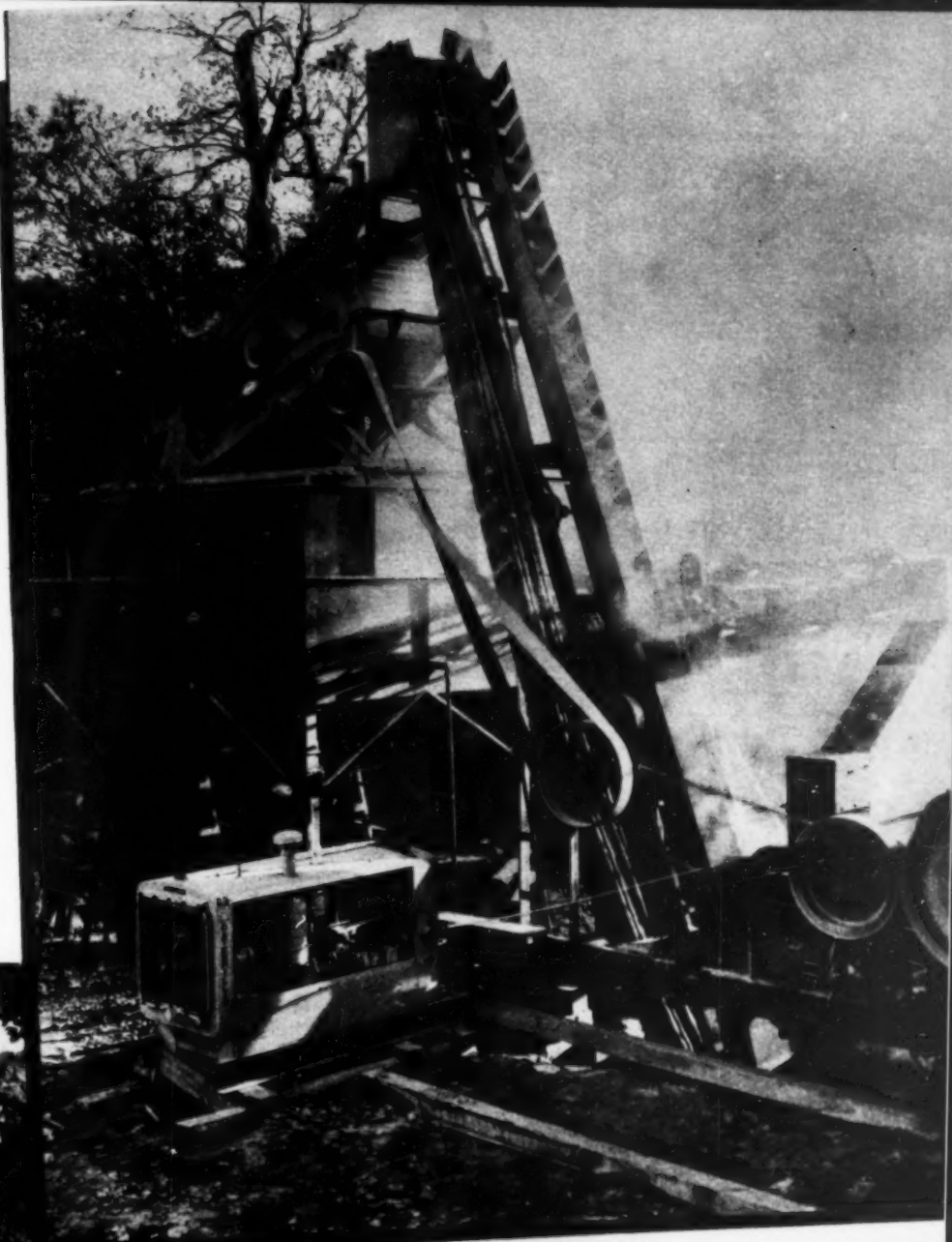


CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS



"Caterpillar" Diesel Tractors are available in sizes from 25 to 113 drawbar horsepower.

"Caterpillar" Diesel Engines are available in sizes from 34 to 190 maximum horsepower.



"Caterpillar" Diesel Motor Graders are available in three sizes.



CATERPILLAR *DIESEL*

ENGINES AND ELECTRIC SETS • TRACK-TYPE TRACTORS • ROAD MACHINERY

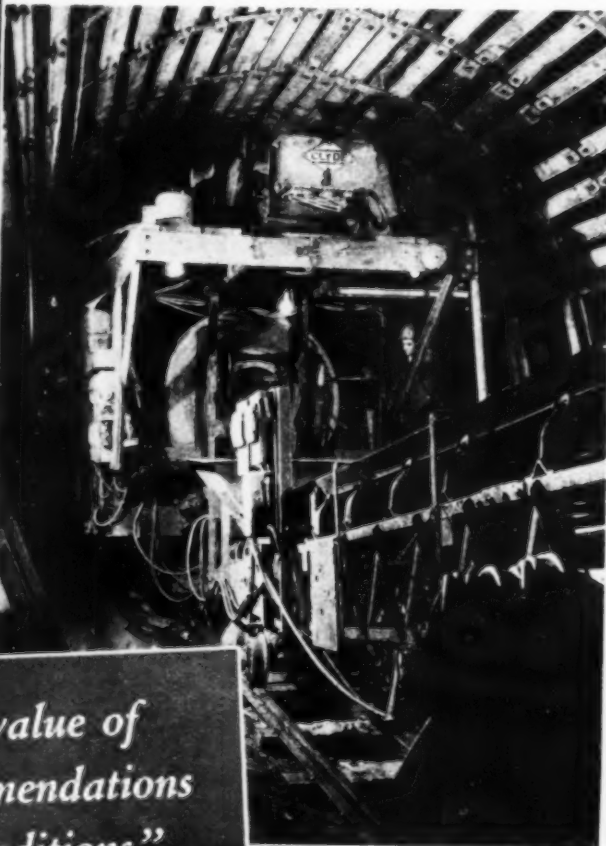
"GULF Q" QUALITY LUBRICANTS

have been a big factor in our fine progress"



Says Delaware Aqueduct Contractor ★

★ The Utah Construction Co., Croton Falls, N. Y., has completed excavation work on its 6.4 mile tunnel contract, and is now lining. This part of the immense project was driven mostly through Highlands gneisses, granites, and schists.



*"We proved the value of
the Gulf Engineer's Recommendations
under severe operating conditions"*

"THANKS to the highly efficient operation of all our equipment, we have made excellent progress on this tough tunnel job," says this Delaware Aqueduct contractor. "We feel sure that Gulf quality lubricants, applied as recommended by the Gulf engineer, has helped us make a fine operating record."

This huge water supply project represents one of the largest and most difficult construction jobs ever undertaken. Work schedules are extremely heavy. Every piece of equipment must give trouble-free service day in and day out. That is why leading con-

tractors have standardized on Gulf lubricants and engineering service. They know they get *effective help* in maintaining the kind of lubrication which insures top-notch performance from equipment and freedom from costly delays.

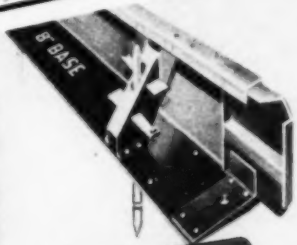
Don't start another job without the benefit of Gulf's higher quality lubricants. They are quickly available to you through more than 1200 warehouses located in 30 states from Maine to New Mexico. Write or phone, your nearest Gulf office today.



GULF OIL CORPORATION · GULF REFINING COMPANY · PITTSBURGH, PA.



TAMPING ROLLERS



ROAD FORMS



CURB AND GUTTER FORMS

BLAW-KNOX

CONSTRUCTION EQUIPMENT

Gives you production... and profit

High-speed production and dependable, trouble-free operation is built into any item of Blaw-Knox Construction equipment you buy. You will get the latest, the most up-to-date development—the best—for Blaw-Knox is always a step ahead.

Phone, wire or write for descriptive literature and prices.

BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
Foster's Bank Building Pittsburgh, Pa.
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TRUCK MIXERS



CONCRETE BUCKETS



CONCRETE SPREADERS



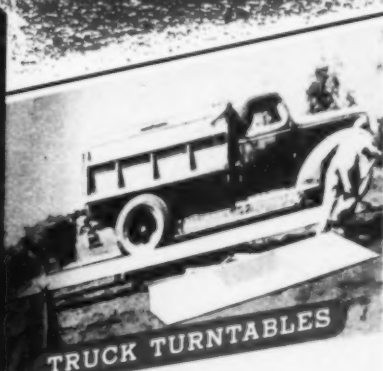
ROAD FINISHING MACHINES



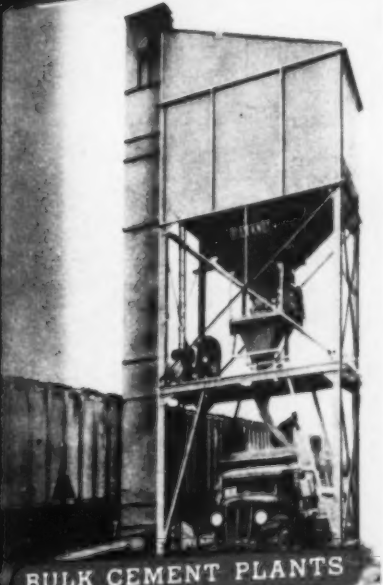
SPREADER-VIBRATORS



TRUCK MIXER LOADING PLANTS



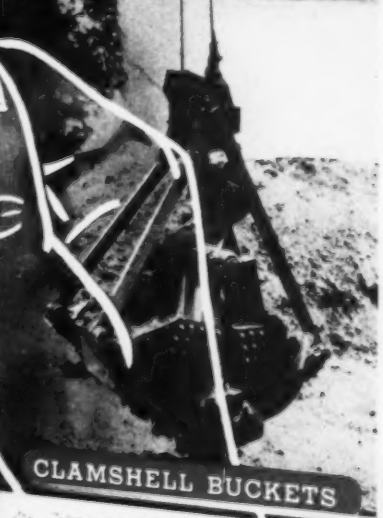
TRUCK TURNTABLES



BULK CEMENT PLANTS



CENTRAL MIXING PLANTS



CLAMSHELL BUCKETS



Fig. 7 - VS-4

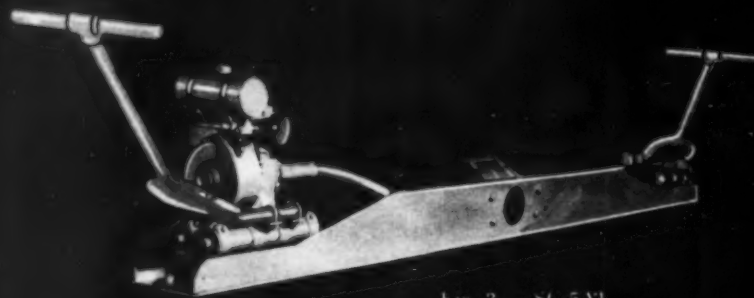


Fig. 2 - SC-5A1

SPEED DEFENSE CONSTRUCTION ...THE JACKSON WAY!

SPEED—The keynote to our national defense program—can only be accomplished with the best of equipment. Consider quality and not first cost alone when purchasing for your contracts.

THE JACKSON WAY means first and always the best. Longer life, more economical in operation, fewer breakdowns, more dependability.

PAVING—The Jackson Vibratory Paving Tube (Fig. 1) designed for placing low slump pavement concrete. Husky and rugged—it's the most practical pavement vibrator ever constructed. Speedy, and a labor saver on all widths. Jackson Vibratory Hand Screeds SC-5A1 (Fig. 2) are used for the many paving operations on highways, floors or decks where a finishing machine is not practical.

PIPE—Jackson pipe vibrators PT-21A (Fig. 3) give denser and nicer appearing pipe, permit early stripping of forms, reduce cost and speed up pouring.

CONSTRUCTION—Jackson Flexible Shaft Vibrators FS-1A (Fig. 4), the Jackson Hydraulic Vibrator HS-1A (Fig. 5), and Electric Vibrator FS-4A (Fig. 6) are designed for all construction jobs and are available in several sizes and speed ranges for the most exacting requirements.

MASS CONCRETE for dams, bridges and like jobs where the huskiest type of vibrator is needed—use the Jackson Model VS-4 (Fig. 7).

POWER PLANTS—WS-4 (Fig. 8) illustrates one of several models of Jackson Portable Power Plants. All models are easily portable, ruggedly designed and economical. Use them where either 3-phase or single-phase, 110-volt A.C. current is required. Service—you demand it—they'll give it.

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON, MICHIGAN

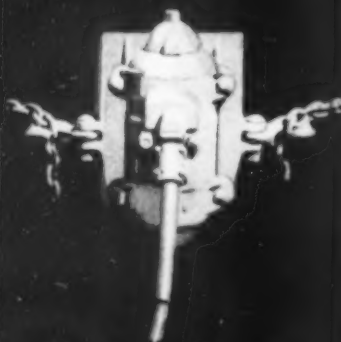


Fig. 3 - PT-21A

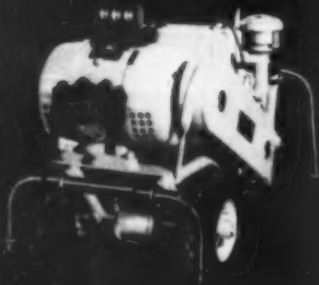


Fig. 8 - WS-4

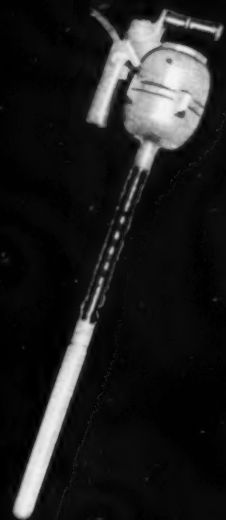


Fig. 6 - FS-4A

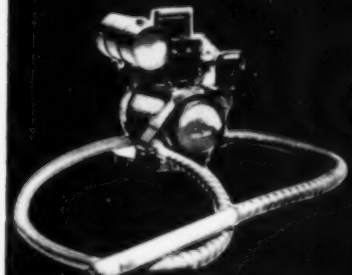


Fig. 4 - FS-1A

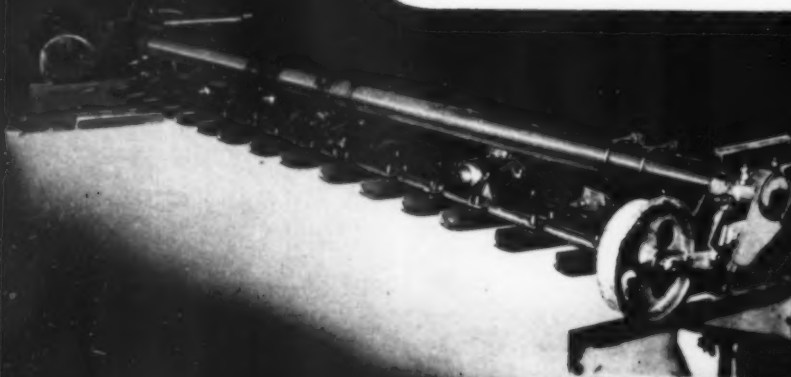


Fig. 1 - Vib. Pav. Tube

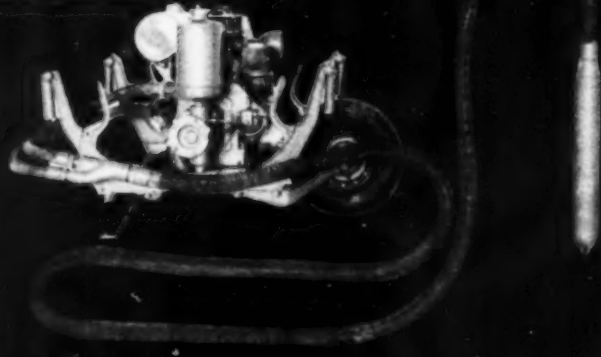


Fig. 5 - HS-1A



AVOID CONSTRUCTION "BOTTLENECKS"

with Economical **LAPLANT-CHOATE** *Earth Moving Equipment*

CARRIMOR
SCRAPERS
3 Yards to 33 Yards
•
BULLDOZERS
•
TRAILBUILDERS
•
RIPPERS
•
TAMPING ROLLERS

UPON the shoulders of the construction industry rests one of the most vital phases of our National Defense program. The building of hundreds of new airports . . . streamlining and maintaining our road system . . . construction for industrial expansion are but a few of the responsibilities you are called upon to assume.

This work must be done well and done fast. But, this is no problem when you are equipped with rugged, dependable, time-saving LaPlant-Choate earth moving tools! Digging, pushing, hauling, scraper work . . . LaPlant-Choate tools perform every operation with extra capacity — extra power — extra speed — and at low cost. This equipment is highly versatile; many of the tools do many different jobs. And because they are specifically designed for use with "Caterpillar" track-type Tractors, you are assured of a perfectly balanced, properly coordinated unit.

On the jobs ahead, there is no room for antiquated or inefficient equipment. Play safe. Modernize now with world-famous LaPlant-Choate equipment. Get full details from your nearest LaPlant-Choate and "Caterpillar" dealer. Write or wire today for Free literature.

LAPLANT-CHOATE
MANUFACTURING CO. Inc.
CEDAR RAPIDS, IOWA.



You'll save time!

Instead of ordering bar mats and reinforcing bars from one source, road joints and steel posts from another, and so on, why not save time and trouble by ordering every road steel need from one source—Bethlehem?


That way you save: Phone bills, bookkeeping, accounting, correspondence expense. Then, from one

of Bethlehem's 15 strategically-located warehouses, or alert jobbers, you'll get deliveries complete, on time. No waiting around on the job for some key item that's lost, strayed, or just delayed.


Call the nearest Bethlehem office for details of Road Steel Service.

BETHLEHEM STEEL COMPANY






HEIL HYDRAULIC TRAILBUILDERS
—Built in seven sizes to fit all Cletrac Tractor Models. Blade can be angled to either side or set in bulldozer position.




HEIL TWIN-CABLE SCOOPS — Four wheel cable scoops built in 6, 8, 10, 12, 16 and 24 yd. capacities. For operation with 40 to 120 H. P. tractor.

FAST DEPENDABLE OPERATION AT
lower cost
EARTH-MOVING EQUIPMENT WITH HEIL



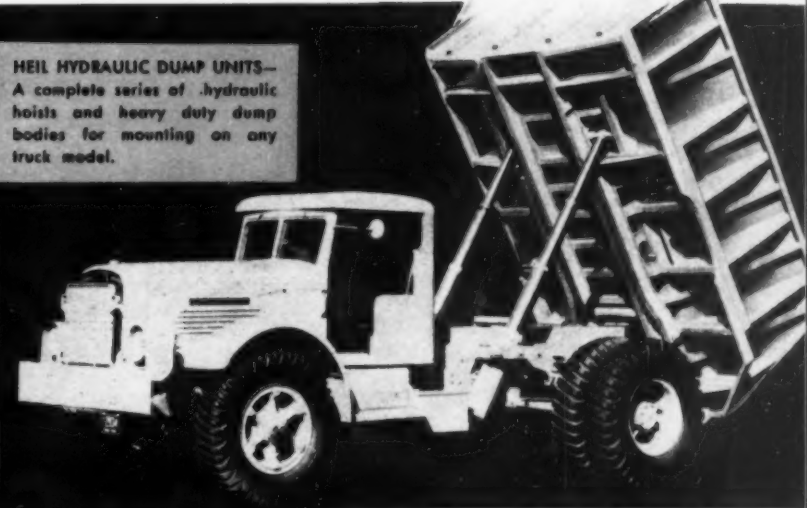
HEIL HYDRAULIC BULLDOZERS— Built in seven sizes to fit all Cletrac Tractor Models.




HEIL SHEEPSFOOT TAMPING ROLLERS—Built in single, double, or triple drum models, either oscillating or non-oscillating.

THE HEIL CO.


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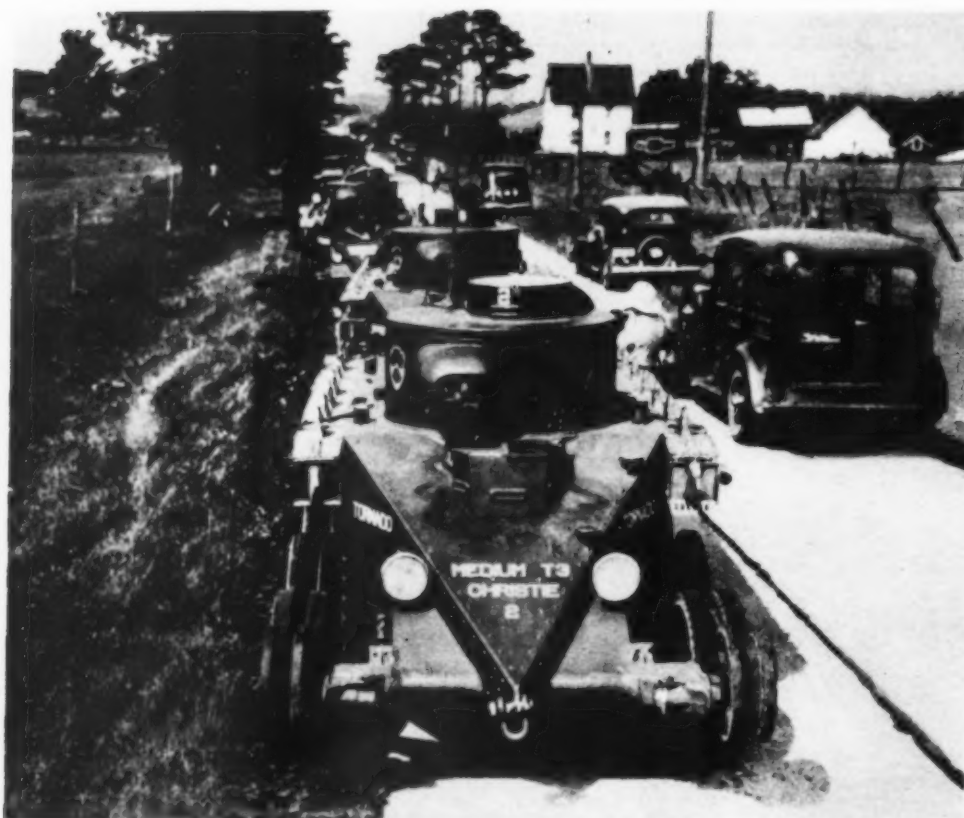
HEIL HYDRAULIC DUMP UNITS— A complete series of hydraulic hoists and heavy duty dump bodies for mounting on any truck model.



HEIL-BAKER SCOOPS — Two wheel hydraulic scoops built in 3, 4 and 5½ yd. capacities. For operation with 30 to 60 H. P. tractors.



HEIL HYDRAULIC DIG-N-CARRY SCOOPS—Four wheel hydraulic scoops built in 6, 8, 12 and 16 yd. capacities. For operation with 40 to 120 H. P. tractors.



NATIONAL DEFENSE

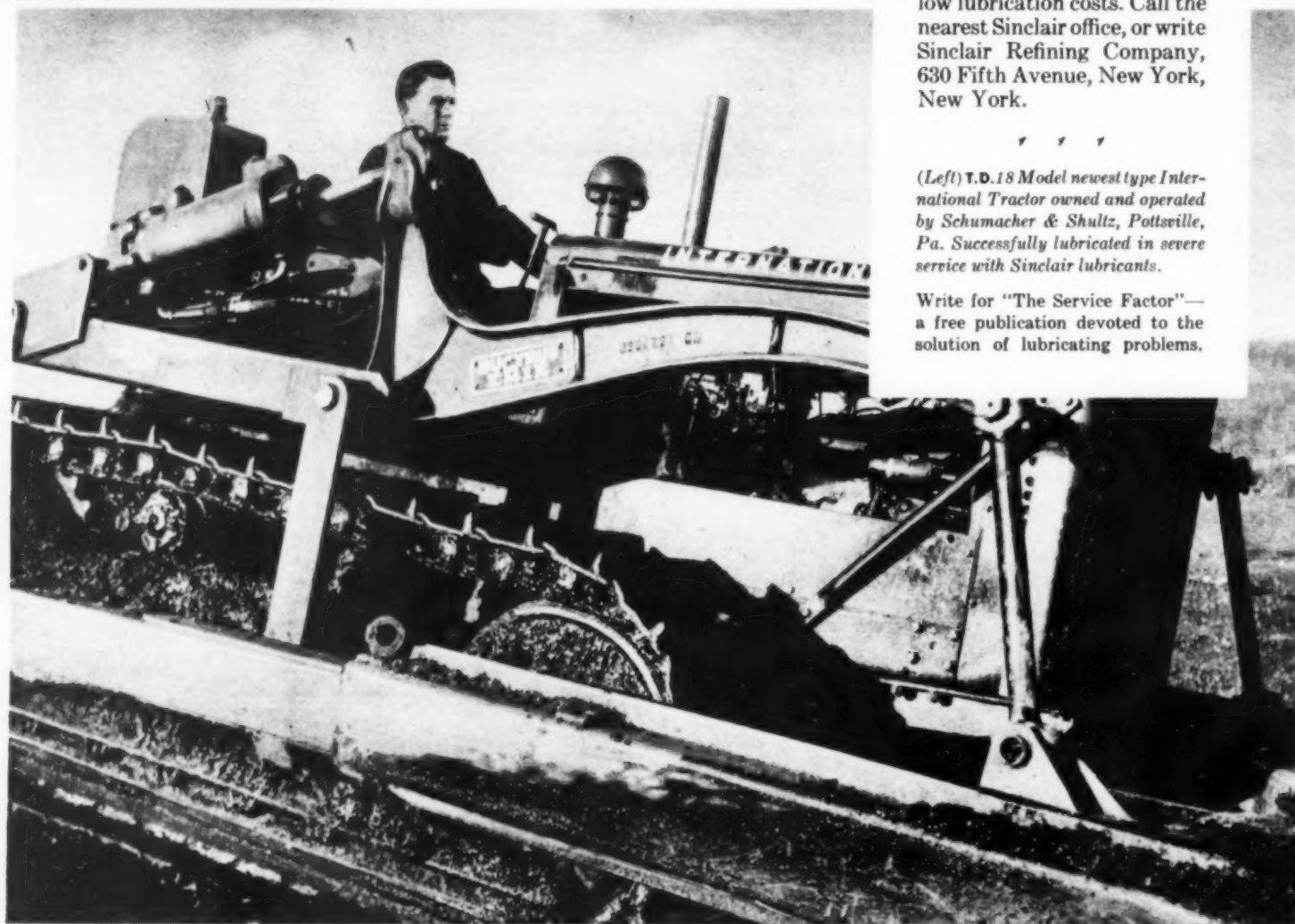
speed-up is putting peak loads and overloads on all types of industrial equipment. *Safe* maintenance of top performance depends on *correct* lubrication. For *earth moving* and *road construction machinery* there are . . .

... SINCLAIR OILS and GREASES specially developed for *safe* peak load operation of all types of equipment. Sinclair's complete line of lubricants and fuels promote sustained delivery of full machine output under toughest service conditions. Try them for keeping equipment on the job at low maintenance and low lubrication costs. Call the nearest Sinclair office, or write Sinclair Refining Company, 630 Fifth Avenue, New York, New York.

✓ ✓ ✓

(Left) T.D. 18 Model newest type International Tractor owned and operated by Schumacher & Shultz, Pottsville, Pa. Successfully lubricated in severe service with Sinclair lubricants.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



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BUILT FOR THE TOUGHEST JOB A SHOVEL HAS TO DO!

If you have a Real Rock Shovel you'll never have to worry about output in dirt. Northwest, from their engines to the tip of the dipper teeth, are rock shovels. Look it over! Bases are cast steel—with cast steel machinery side frames. Here is shock withstanding ability that maintains shaft alignment and minimizes wear. Swing clutches are Uniform Pressure Clutches—cool running—no machine straining jerks or grabs—less adjustment. The Cushion Clutch makes high power safe—reduces overloads on all parts under power. The Welded Boom is proved in rock work—no Northwest Welded Boom has ever failed. The Dual Independent Crowd utilizes force other shovels waste giving greater digging power in the cut. Welded Dipper Sticks and many other advantages put Northwest in the lead. The whole story can't be told here. Northwest has advantages that make money. That's why one out of every three sold is a repeat order. Let us send you complete details.

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ENGINEERING COMPANY**
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Chicago • • • Illinois

NORTHWEST

Shovels • Cranes • Draglines • Pullshovels • Skimmers

.... If it's a
real Rock Shovel
you won't have
to worry about
output in dirt!



Every ounce of power and concentrated effort is needed today on defense projects. Baker Equipment has the stamina to push such jobs to early completion.

Baker Hydraulic Bulldozers and Gradebuilders are getting the tough jobs today, finishing them and asking for more. Their easy control and efficient hydraulic system, backed by rugged construction, make them the choice of contractors who get things done.

Other Baker products are on the job, too—easy loading Hydraulic Scrapers, Rotary Scrapers for short hauls and Road Rooters to rip up tough places—and Baker Road Discs and Maintainers to help you keep important roads passable without heavy expense. Bakers are ready to do a real job for you—just call them in!

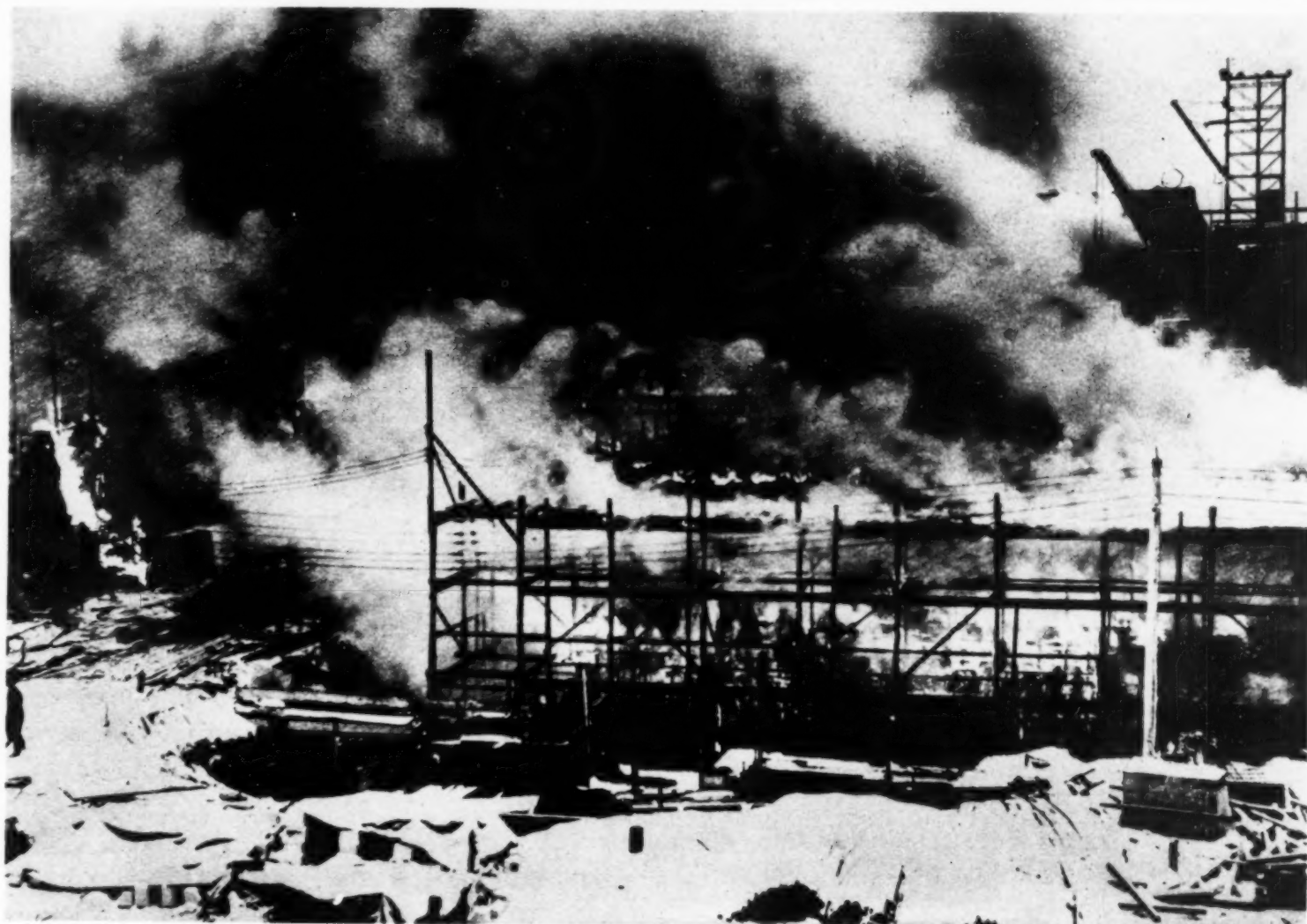
*Write or Wire for Special Bulletins
on Any Baker Product*

THE BAKER MFG. CO.
568 Stanford Ave., Springfield, Illinois

BAKER
TRACTOR EQUIPMENT

BULLDOZERS, GRADEBUILDERS
ROAD ROOTERS, SCRAPERS
ROAD DISCS, MAINTAINERS
SNOW MOVING EQUIPMENT

\$500,000 Loss Due To Flammable Canvas!



Chicago Tribune Photo

FIRE CHIEF Finished Duck would have prevented this needless building construction loss where an overturned salamander ignited a flammable canvas wind-break to cause a disastrous fire, entirely consuming 300,000 sq. ft. of canvas and the scaffolding, and seriously damaging the incompleting building.

Wherever unprotected canvas presents a fire hazard from hot coals, sparks, hot rivets, welding operations or workmen's torches, carelessly thrown cigarettes and matches — FIRE CHIEF Finished Duck assures new safety.

Approved by the Underwriters Laboratories and the Associated Factory Mutual Fire Insurance Companies, FIRE CHIEF also meets all Government requirements for a fire-, water-, weather- and mildew-resistant canvas.

Specify FIRE CHIEF for protection.

WM. E. HOOPER & SONS CO.
New York PHILADELPHIA Chicago
Mills: WOODBERRY, BALTIMORE, MD.

FIRE CHIEF

The Finish That WON'T WASH OUT

THESE ROEBLING "4" count heavily IN ROPE SERVICE



PROFIT FROM

all 4

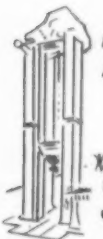
IN ROEBLING ROPE

- 1 UNUSUAL ORGANIZATION
- 2 EXCEPTIONAL FACILITIES
- 3 AGGRESSIVE RESEARCH
- 4 100 YEARS EXPERIENCE

ROEBLING "Blue Center" STEEL WIRE ROPE



1 Unusual Organization—One of country's most complete and experienced wire rope organizations.



2 Tower of Torture—An example of Roebling's exceptional facilities is this giant Riehle—one of the largest precision testing machines in the world.



3 Metallurgical Improvements—A constant program of wire rope research is carried on in the Roebling Research Laboratory. One of country's finest and most completely equipped research units.

4 100 Years Experience—America's first wire rope was made by John A. Roebling over 100 years ago!

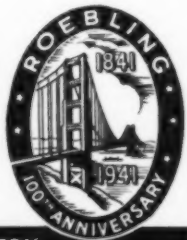
When you buy Roebling "Blue Center" Steel Wire Rope you don't get merely a good rope. You get the finest wire rope that money can buy—a rope that, if used on all your rope-rigged equipment, will assure you of utmost over-all rope safety and minimum general-average rope operating cost.

Why? Because of the "4" Roebling Advantages listed above—100 years of "Know How" plus everything that modern science, equipment, and organization can contribute.

Ask the nearest Roebling office or distributor for further information.

Proof (CASE HISTORY #795)

Large general contracting company in New York City has used Roebling "Blue Center" Steel Wire Rope for 15 years. Master Mechanic of this company states that he uses "Blue Center" because of "his long and satisfactory experience with it on many jobs".



JOHN A. ROEBLING'S SONS COMPANY

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• The Controlled Tilting Dipper may be tilted into any one of these positions at any time, and can be held in any of them for digging or dumping. It's a cinch to cut a vertical wall downwardly opposite the machine or cut a level floor. You can change the "rake" or digging angle of the dipper for maximum efficiency in various materials.

In dumping, the Controlled Tilting Dipper gives you a choice of casting materials or holding them cupped within the dipper for accurate spot dumping at either a far-out or close-in radius. Such control eliminates wasteful spilling; assures "full dipper delivery" to spoil bank or truck.

This exclusive Lorain feature brings new efficiency to trenching and basement operations—extends the usefulness of the backdigger to many other types of general excavation work. Write today for data on Lorain Backdiggers with the Controlled Tilting Dipper.

THE THEW SHOVEL COMPANY
LORAIN, OHIO

Only **LORAIN BACKDIGGERS** Give You This **DIGGING and DUMPING**



The Controlled Tilting Dipper is
standard on all Lorain Backdiggers
of 1 cu. yd. and up



**PROVEN
TRACTOR
POWER
UNIT**

...SPEED

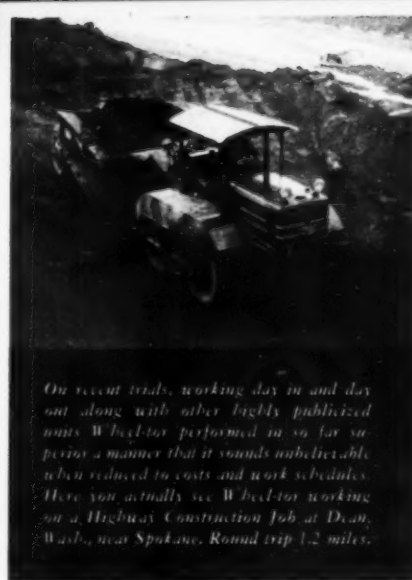


U. S. and
Foreign Patents
Pending.



YOU are looking at the first published photographs of the Wheel-tor. The new, sensational "Prime Mover", closing that gap between crawler tractor and truck operation. Wheel-tor is tomorrow's answer to today's demand for "Power with Speed."

WHAT IS IT? Simplified, Wheel-tor is a conversion unit that replaces only the track frame and crawler tracks of the tractor, retaining the chassis, power unit, steering system and the tractor maneuverability. Has 4-wheel drive. Uses standard tractor parts, assures convenient dependable service. This Wheel-tor with months of strenuous trials and breakdown tests under its belt, is mounted on an International TD-14. Over rough roads, paved highways and even into soft working the Wheel-tor is handling the 10 yard WX Karry-Skraper Unit at speeds up to 20 M.P.H. loaded. The enthusiasm shown by Engineers, operators and laymen alike is most gratifying. Wheel-tor is proving itself 100%. We want you to have these facts about Wheel-tor, want you to know of its possibilities, even to follow its days of stamina tests. Keep your eye on Wheel-tor.



On recent trials, working day in and day out along with other highly publicized units Wheel-tor performed in so far superior a manner that it sounds unbelievable when reduced to costs and work schedules. Here you actually see Wheel-tor working on a Highway Construction Job at Dean, Wash., near Spokane. Round trip 1.2 miles.



Here are some of the purposes for which Wheel-tor can be used in your business other than the one illustrated here. As a booster power unit, as a prime mover over dirt or paved surfaces at speeds of 20 M.P.H. and over, as a utility power unit around airports, lumber yards, industrial plants and in logging operations. Remember Wheel-tor will not damage paved surfaces, yet has unbelievable traction in other materials, thanks to modern pneumatic tire design. Can be operated by Crawler tractor operators without special instruction.

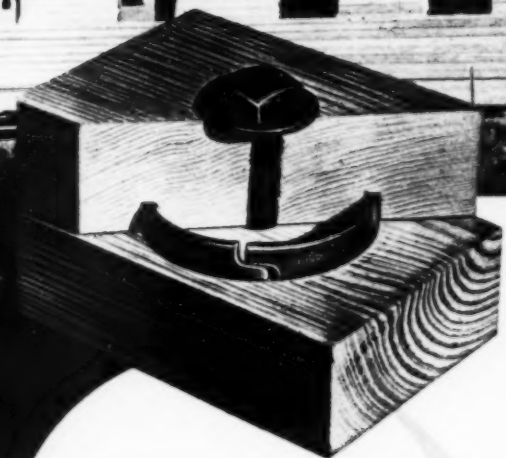


AN ALL-PURPOSE PRIME MOVER

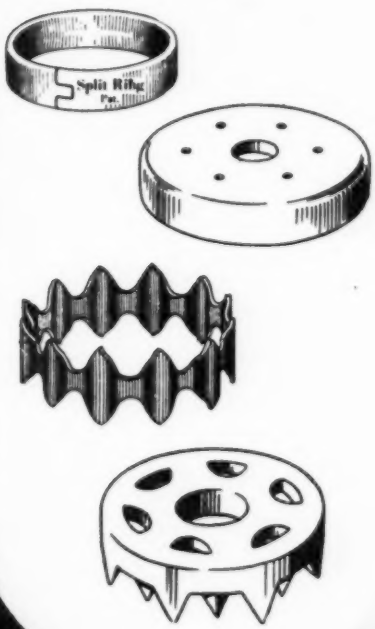
Wheel-tor

I S A A C S O N I R O N W O R K S
Seattle

Lumber Has Done a Job...



These TECO Timber Connectors spread the load on a timber joint over practically the entire cross section of the wood. In bolted joints this stress is localized around the bolt.



RESPONDING to emergency defense demands for quick delivery, the lumber industry has "come through"

Uncle Sam called on the lumber industry to deliver in 3 months enough lumber for the housing of over 1,000,000 men. Lumber made good—today over 1,500,000,000 feet of lumber echoes to the morning bugle call in America's new cantonments.

LUMBER IS DOING AN EMERGENCY *Defense Job*

no other building material can do. First, because it is the material best suited to National Defense Construction — Second, because the new TECO Timber Connectors contribute greatly to the efficiency and economy of lumber construction.

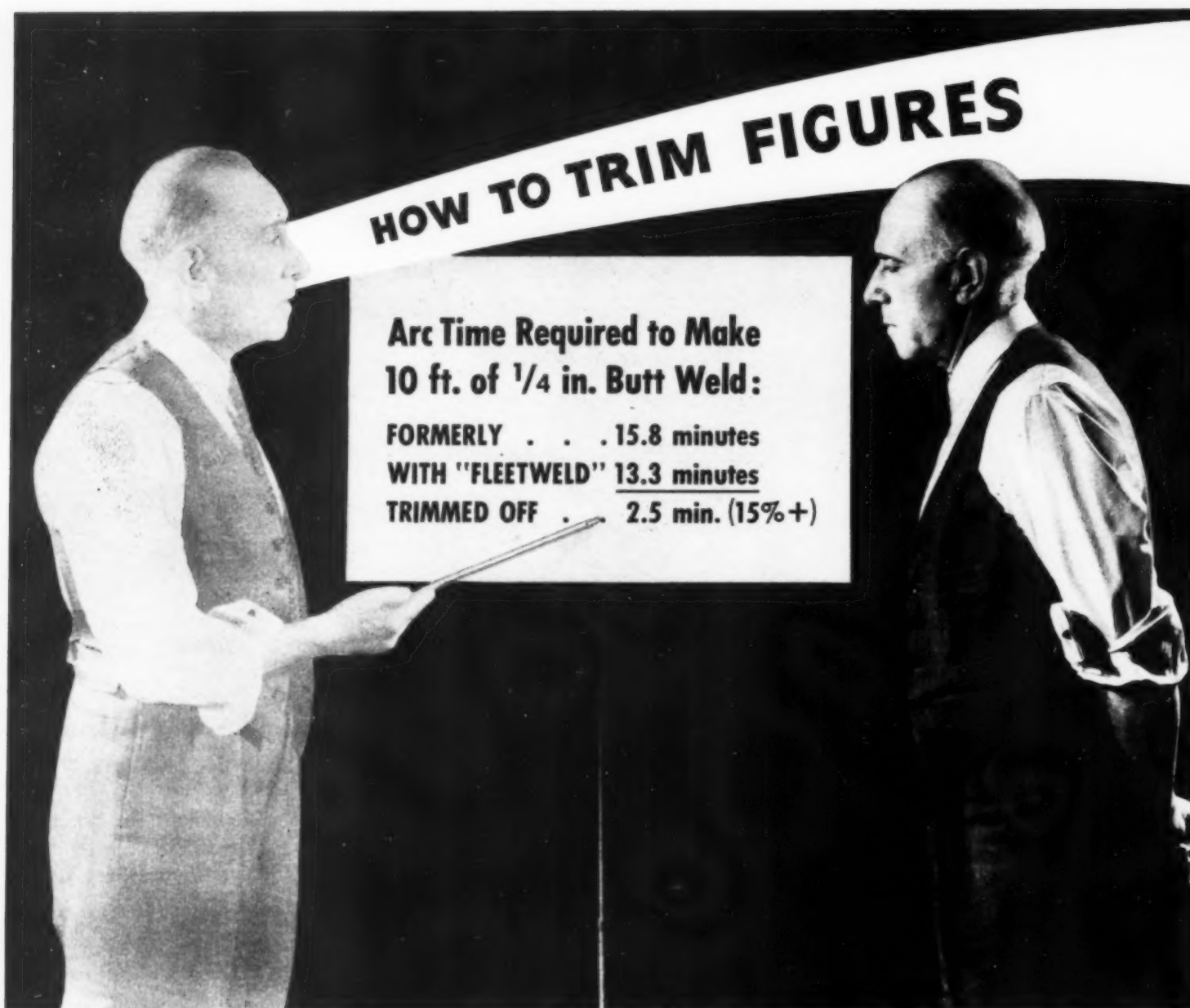
Mail Coupon TODAY for full Information on TECO Connectors

TIMBER ENGINEERING COMPANY, Inc.

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<small>TIMBER ENGINEERING COMPANY, INC., DEPT. M-4 1337 CONNECTICUT AVENUE, WASHINGTON, D. C. Please send us your FREE Booklet "Designing Timber Connector Structures".</small>	
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"AMERICAN STANDARD LUMBER FROM AMERICA'S BEST MILLS"



HOW TO TRIM FIGURES

**Arc Time Required to Make
10 ft. of $\frac{1}{4}$ in. Butt Weld:**

FORMERLY . . . 15.8 minutes
WITH "FLEETWELD" 13.3 minutes
TRIMMED OFF . 2.5 min. (15%+)

ALTER EGO: Literally "one's other self"—the still, small voice that questions, inspires and corrects our conscious effort

ALTER EGO: I don't care how you argue . . . *the speed-up in production* you're looking FOR is in this electrode you're looking AT.

Then you mean it's all that the name implies: "FLEETWELD."

ALTER EGO: And how! With that rod we can step up $\frac{1}{4}$ -inch butt welds from 38 feet to 45 feet per hour. And get high-strength, ductility and smoothness, too.

Say—that's 7 feet per hour faster.

ALTER EGO: And the *faster* you deposit on the work, the *more* you deposit in the bank!

. . .

LINCOLN SUGGESTS: There are many ways to speed up weld production. Use "Fleetweld" for maximum deposit rates. Use large electrodes and positioned work. Use bending and forming to eliminate joints. Use fixtures to quicken setup and tacking. For ideas on "figure trimming," see "Factors In Low-Cost Manufacture of Welded Products" (gratis).

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LINCOLN "SHIELD-ARC" WELDING

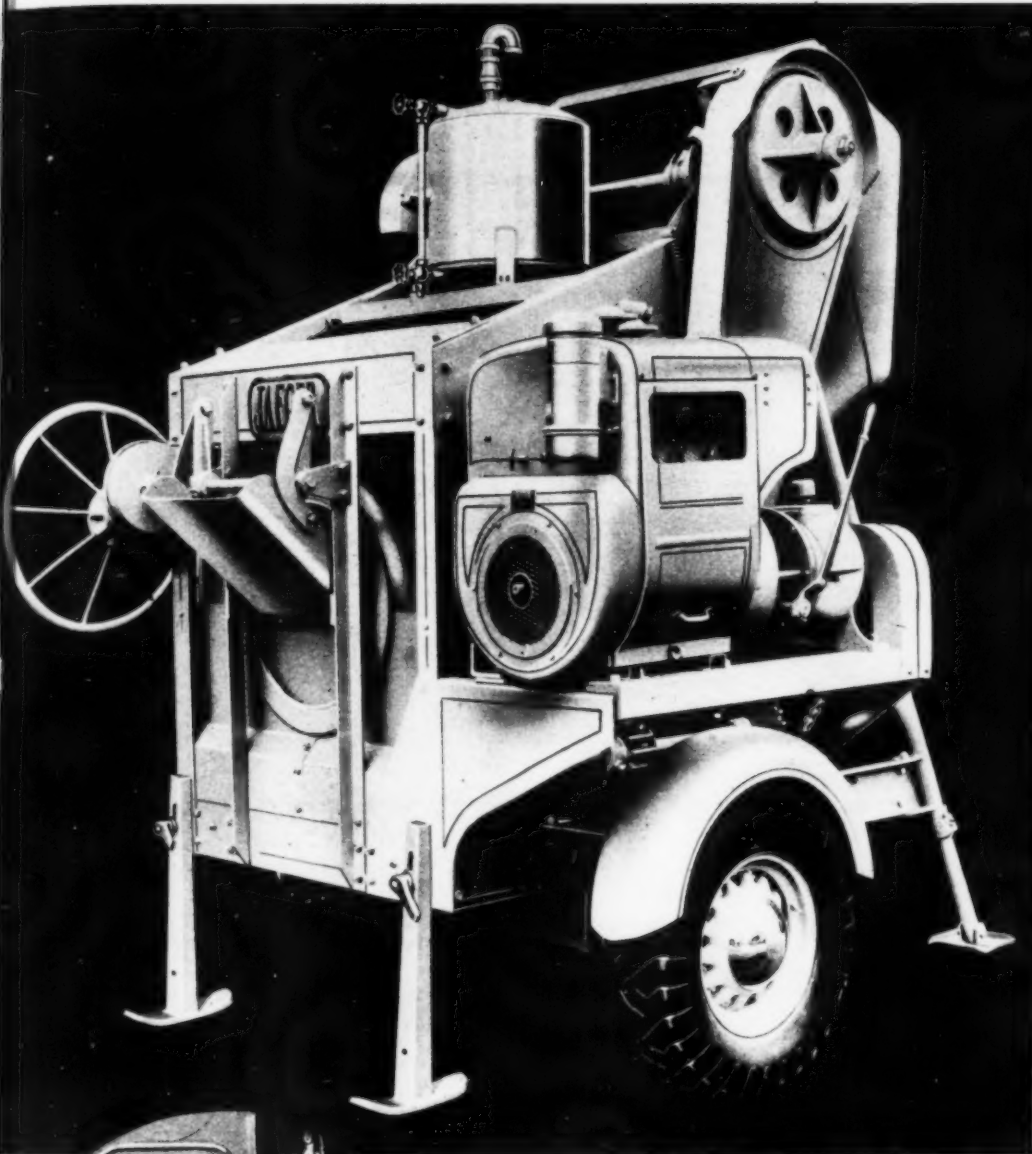
THE LINCOLN ELECTRIC COMPANY
Cleveland, Ohio

Authoritative Information on Design • Production • Welding Equipment

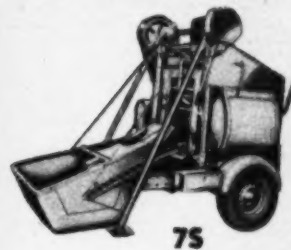
JAEGER ~~SPEEDLINE~~ MIXERS

with MACHINED STEEL DRUM TRACKS and AUTOMOTIVE-TYPE TRANSMISSION

GET THOSE PROFITS THAT SLOWER MIXERS CAN'T PRODUCE



5S — 7S — 10S —
14S Alike in
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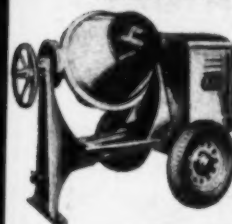
14S

LOADERS
UP TO
90" WIDTH

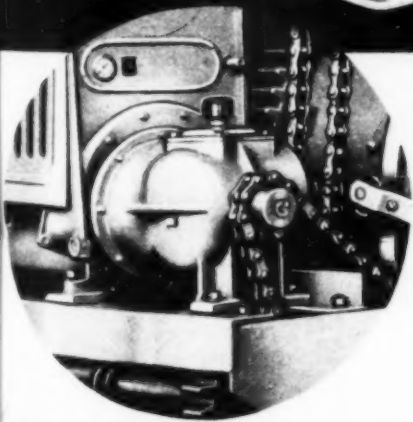


2 or 4-Wheel
Mountings
Interchangeable

End Discharge Half-Bag
Trailer with Measuring Batch
Hopper



Also Tilting
Mixers: 3½S, 5S, 7S
— Plaster-Mortar Mixers, 6
and 10 Ft. Sizes—Cold Mix Plants



DEMAND THIS MODERN MIXER TRANSMISSION

Heavy duty ball bearings and machined, alloy steel gears run in oil, enclosed from dirt and weather—30% to 40% more efficient, 90% quieter, practically LIFE-TIME service. Makes other types obsolete.

**They're Light, They're Fast, They're Portable, Yet
They'll Out-Mix and Out-Last Any Previous Heavy Duty Mixer**

These SPEEDLINE models have all the features that have made Jaeger the world's biggest selling line of mixers, plus latest improvements . . . faster trailing, easier handling, space-saving Jaeger end-discharge design—fast Skip Shaker Loader and "Pressure" Discharge matched by no other mixer—patented Criss-Cross "Re"-Mix Action—plus AUTOMOTIVE-TYPE TRANSMISSION RUNNING IN OIL, MACHINED STEEL DRUM TRACKS RUNNING ON

CHILLED, BALL BEARING ROLLERS, OVER-SIZE ENGINES and VITAL PARTS OF HIGHEST TYPE CONSTRUCTION NOT FOUND IN FLIMSY "LIGHTWEIGHT" MIXERS OF RECENT YEARS.

From half-bag to half-yard size, from tires to top of tank, your SPEEDLINE Trailer will run smoother, quieter and longer, mix more batches at lower cost than any other mixer Jaeger has produced.

SEND TODAY FOR
COMPLETE CATALOG
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THE JAEGER MACHINE COMPANY
800 Dublin Avenue, Columbus, Ohio

Gentlemen: Please send new Catalog of 1941 model mixers with all improvements and prices. ☐ Non-Tilts ☐ Tilters

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Things sure do move when **CHEVROLET TRUCKS** go to work



Inspect these
NEW 1941 FEATURES

★ TWO NEW VALVE-IN-HEAD ENGINES . . . STANDARD: 174 FOOT-POUNDS OF TORQUE—90 HORSEPOWER . . . "LOAD-MASTER": 192 FOOT-POUNDS OF TORQUE—93 HORSEPOWER* ★ NEW RECIRCULATING BALL-BEARING STEERING GEAR ★ NEW, MORE COMFORTABLE DRIVER'S COMPARTMENT.

*Optional on Heavy Duty models at extra cost

60 MODELS

ON NINE LONGER WHEELBASES . . .
A COMPLETE LINE FOR ALL LINES
OF BUSINESS

They have **EXTRA** horsepower . . . **EXTRA** pulling power . . . **EXTRA** earning power

There's a lot of work to be done in this country this year—more material to be moved, and moved fast; more goods to be delivered, and delivered on schedule; more supplies to be hauled, and hauled promptly.

It's a year for heavy duty trucks with extra power—and that makes it a year for Chevrolets, because they are the most powerful trucks in the low-price field.

There are full 90 horsepower and the tremendous *pulling* power of 174 foot-pounds of torque in Chevrolet's Standard engine. If you need more, there are 93 horsepower and 192 foot-pounds of torque—extraordinary pulling power for extraordinary duty—in the special heavy duty "Load-Master" engine, optional at a small additional charge.

Be ready for peak loads—with the trucks that can carry them.

CHEVROLET MOTOR DIVISION, General Motors Sales Corporation
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OUT-PULL . . . OUT-VALUE . . . OUT-SELL



GENERAL

looks well on Parade—but
a whole lot better on the
job, and on the profit side
of the ledger. Remember—
GENERAL gives you more.

NOT A DRESS PARADE!

But 4 of the 5 GENERALS, that helped to build
the new Baltimore Airport, lined up hard at work
on this important project.

The GENERAL'S Staff will help you on your
work also. Drop a postal today for full in-
formation.

The OSGOOD COMPANY

Sizes: $\frac{1}{2}$ to $2\frac{1}{2}$ Cu. Yd.
Diesel - Oil - Gas - Electric

Associated with
The GENERAL
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HERCULES
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6 to 12 Tons
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GENERAL

Sizes:

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SHOVELS

DRAGLINES - CRANES
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THE GENERAL EXCAVATOR COMPANY, Marion, Ohio

The BIGGER your tires *..the better your PROFITS!*



Caterpillar Diesel Motor Grader with Goodyear Sure-Grip tires on Pennsylvania turnpike

IN off-the-road work there's an important relation between the size of your tires and your profits. Experience proves it pays to use *bigger, wider* tires than in normal highway service, for these three important reasons:

BIGGER TIRES provide sufficient air-cushion underwheel to "float" loads over soft surfaces where ordinary tires bog down — insure faster operation.

BIGGER TIRES "flow" over rocks without gouging or cutting — give longer wear.

BIGGER TIRES roll freely without bead strain or rim-cutting — prevent carcass failures.

To give contractors these advantages, Goodyear builds off-the-road tires in sizes up to 24.00 inches cross-section

— in three different types of tread specially designed for mud, rock and dirt operations.

You will find these tires today on many of the largest earthmoving vehicles because they carry full-capacity loads at higher speeds — with greater maneuverability — and because they give longer service.

If you want these double savings, see your Goodyear dealer about the proper size and type of Goodyear tire for your equipment.

All-Weather — T. M. The Goodyear Tire & Rubber Company

THE RIGHT GOODYEAR FOR EVERY JOB



THE GREATEST NAME IN RUBBER
GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Construction Methods

ROBERT K. TOMLIN, Editor

Volume 23

APRIL, 1941

Number 4



COULEE DAM STARTS *Power Generation*



WORLD'S LARGEST CONCRETE DAM (right) is U. S. Bureau of Reclamation's Grand Coulee structure on Columbia River, with a volume of about 12,000,000 cu.yd., height of 550 ft. and crest length of 4,300 ft. On March 22 switch was thrown to start giant generators producing electric power for first time. Powerhouse is shown in lower right hand corner of photograph. **POWER FROM GRAND COULEE DAM** will be delivered by 230,000-v. transmission line (**above, left**) of Bonneville Power Administration 234 mi. to Vancouver, Wash.

CALLED TO THE COLORS two years ahead of schedule by vital defense needs for electric power, Grand Coulee dam, U. S. Bureau of Reclamation structure across the Columbia River in Washington, went to work at noon March 22 when gates were opened to admit water to the turbines operating big electric generators which ultimately will develop 2,700,000 hp. While the first construction contract (for removal of overburden) was let in December, 1933 work on a large scale really got under way when, on July 13, 1934, the Mason-Walsh-Atkinson-Kier Co. received a \$29,339,000

contract for the 250-ft. high base of the dam, completed early in 1938. Under a second contract awarded January 28, 1938 to Consolidated Builders, Inc., for \$34,442,240, the dam was raised to its full height of 550 ft. At the peak of employment 7,400 men were working on the project.

With a height of 550 ft. and a crest length of 4,300 ft. Grand Coulee dam, requiring the placement of about 12,000,000 cu. yd. of concrete, is the world's largest in volume and second only in height to the 727-ft. Boulder dam.

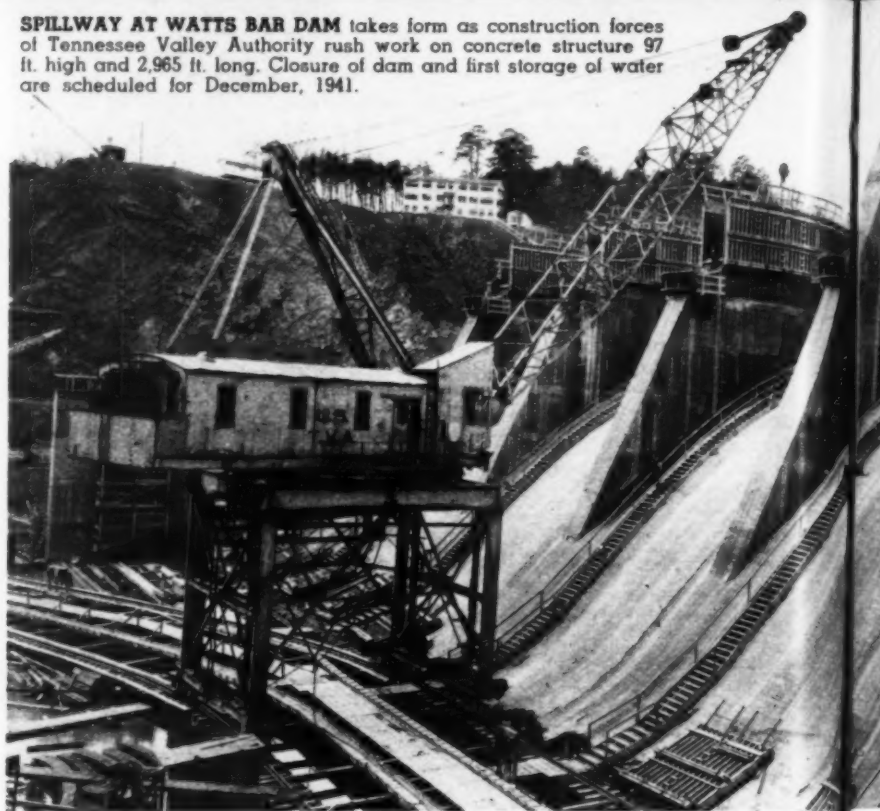


FRANK A. BANKS, supervising engineer, U. S. Bureau of Reclamation, turns knob which starts operation of first 10,000-kw. generator in world's largest powerhouse.



AT DIZZY HEIGHT above canyon of Pit River in California, workmen rig steel-mesh catwalk from concrete pier 358 ft. high, preparatory to erection of steel superstructure for what will be highest double-decked span in world. Bridge, involving 17,110 tons of steel, is largest of 8 major bridges built by U. S. Bureau of Reclamation to relocate railroads and highways around reservoir to be formed by Shasta dam.

SPILLWAY AT WATTS BAR DAM takes form as construction forces of Tennessee Valley Authority rush work on concrete structure 97 ft. high and 2,965 ft. long. Closure of dam and first storage of water are scheduled for December, 1941.

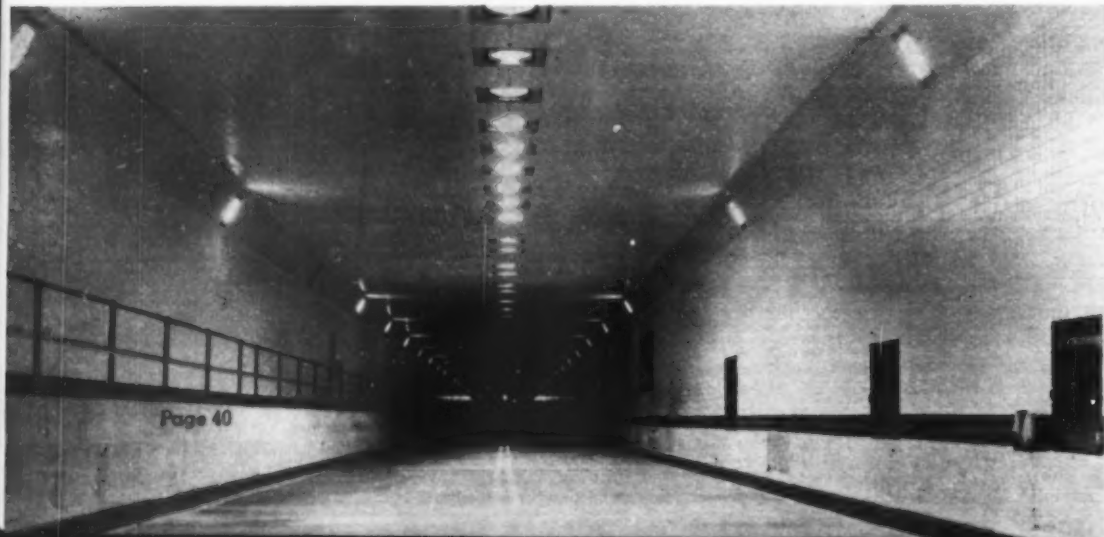


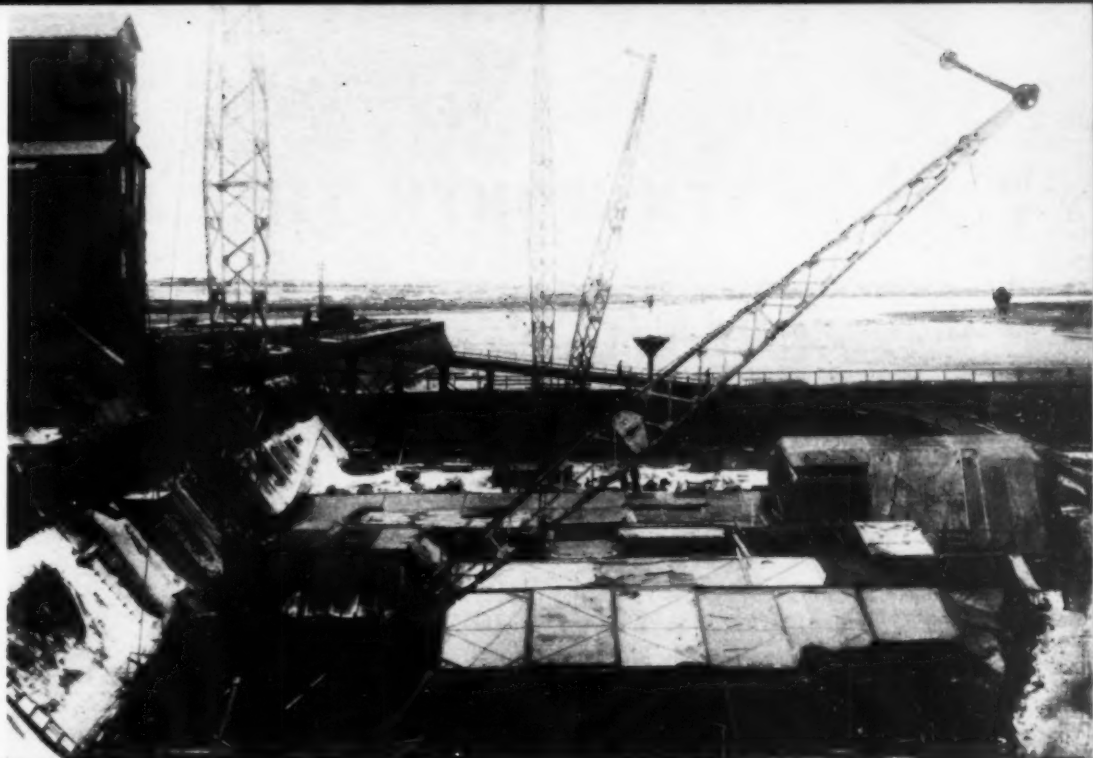
THIS MONTH'S NEWS REEL



BANKHEAD VEHICULAR TUNNEL (below, left and right) under Mobile River, Mobile, Ala., is opened to traffic Feb. 20, just 21 months after signing of \$3,000,000 contract for 3,400-ft. two-lane subaqueous crossing by Arundel Corp., Baltimore, and City of Mobile. Constructed by trench method, with seven concrete-incased welded steel sections forming 2,000 ft. of tunnel joined together under water, completion was retarded about 7 months by extremely difficult ground conditions encountered in driving steel sheet-

piling and excavating for open-end trench to take three final prefabricated sections at Mobile end of project. Of \$4,000,000 total cost, \$1,500,000 was PWA grant, and \$2,500,000 was in bonds sold to RFC. For Wilberding & Palmer, Mobile, engineering and financial consultants to city on tunnel, R. F. Schaefer is chief engineer and engineer of design. Elliott H. Burwell, supervising construction engineer, was in charge for Arundel, and Edward H. Hopson was project engineer for PWA.





COLD WEATHER COVERING of plywood and canvas protects concrete pouring operations by Woods Bros. Construction Co., of Lincoln, Neb., on substructure of power house of Fort Peck dam, U. S. Engineer Department project on Missouri River in Montana.



DEDICATION OF RADFORD ORDNANCE WORKS in Virginia, described elsewhere in this issue, takes place March 14, as Under Secretary of War Robert P. Patterson addresses workers on job. Huge project costing \$41,000,000 is being built by Hercules Powder Co., general contractor, and Mason & Hanger Co., Inc., of New York, sub-contractor, for manufacture of smokeless powder for army use. Wide World Photo

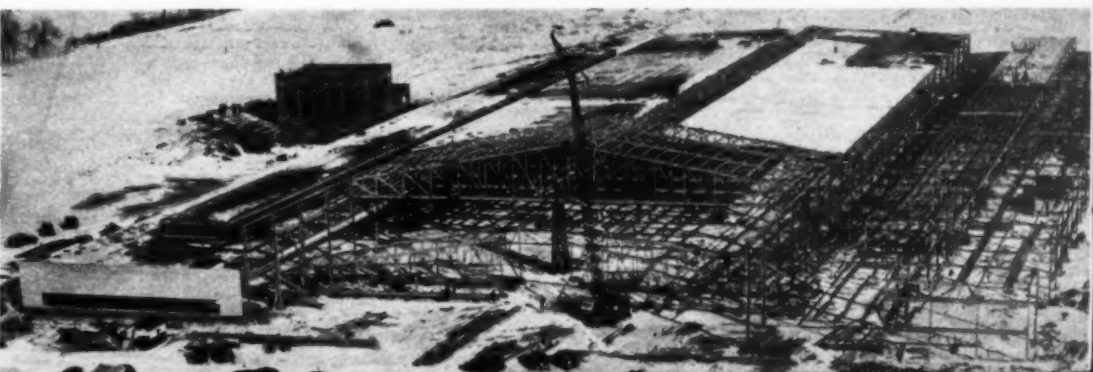


FORD AIRPLANE ENGINE PLANT, to cost \$21,000,000 nears completion at Dearborn, Mich., as workers remove 900,000 sq.ft. of fiber-board shelter erected to permit construction operations to proceed during winter weather. Entire plant, which is 1,000 ft. long, 360 ft. wide, will soon start production of initial order for 4,236 Pratt & Whitney engines. Designed for operation during "blackout," building is protected by thick slabs of reinforced concrete on roof and over service tunnels. General contractor on project is Esslinger-Misch Co., of Detroit.



ARSENAL FOR ARMY TANK PRODUCTION takes form at Chrysler Corp. plant site in Detroit, Mich., as O. W. Burke Co., contractor, rushes work on 1,380x500-ft. assembly building. Project for national defense will cost \$20,000,000.

AT BELL AIRCRAFT ASSEMBLY PLANT (right) near Niagara Falls, N. Y., The Austin Co., of Cleveland, rushes steel erection on \$1,050,000 building despite handicap of winter weather. Photo shows more than two-thirds of 2,000-ton steel frame structure, providing 300,000 sq.ft. of floor space, under roof. Final assembly bay, 200 ft. wide is spanned by eight 35-ton trusses.



TEN-MONTH TIME LIMIT SPURS 21,000 Construction Workers ON \$41,000,000 POWDER PLANT

EFFECTIVE ENERGY worthy of smokeless powder, the plant's eventual product, motivates the field staff assembled by the War Department, the Hercules Powder Co. and the Mason & Hanger Co., to build the \$41,000,000 government-owned and Hercules-operated Ordnance Works, at Radford, Va., scheduled to start production by June 16, just 10 months after the signing of the original contract by the powder company, the Chief of Ordnance and the Quartermaster General. A force of more than 21,000 employees and nearly 1,000 equipment units is working on three shifts, 24 hr. a day, to complete 600 permanent buildings and essential utilities, such as power and water, in the 10-month time limit stipulated by the original contract, which called for \$25,000,000 worth of construction in two production lines for making large quantities of smokeless powder. At the present pace of construction it is confidently expected that the contract date will be met, despite a setback of 4 to 8 weeks on many units caused by cessation of activities to permit rearrangement and respacing of certain buildings for greater safety, as a result of lessons learned from the explosions at the Kenvil, N. J. powder plant on Sept. 12, just 6 days after work got under way at Radford. The rapid rate of construction necessary to wipe out this deficit is being maintained despite the expansion of the plant by supplemental contracts adding a third powder line, which will increase the daily capacity of the completed plant and the estimated total construction cost to more than \$41,000,000.

Pre-Planning by Army

Forehanded purchase and storage at the Picatinny, N. J. arsenal of essential powder-making machinery by the Army's Ordnance Department make it possible to equip the Radford Ordnance Works and other plants for operation in the short time limits required by the present emergency. Matching this providential action by the Army, rapid development of plans by the Hercules designing department in Wilmington, Del., and prompt execution of the plans in the field by the powder company and its subcontractor, the Mason & Hanger Co., are quickly completing a home for the pre-stocked powder-making machin-

By VINCENT B. SMITH
Associate Editor
Construction Methods



1...General

*Army-Contractor Team
Surpasses Scheduled
Progress in Race for
Smokeless Powder*

ery and other more readily procurable equipment recently acquired under the contract. Fast progress with good workmanship is the objective of all government and contractor representatives on the job, and the project moves rapidly as a result of the effective cooperation and teamwork of these agencies.

Essential Utilities

Powder manufacture requires an abundance of steam and water of good quality, and the time required for erection of the steam power plant actually determines the construction period for the project as a whole. Other facilities can be completed within the time required for the power house. The Government power plant houses four huge boilers and turbo-generators, including one standby unit, in a steel-frame building with brick closure walls. As a safeguard, plant power lines are connected into the high-tension system of the Appalachian Electric Power Co. to take care of any temporary shutdowns of the power house.

Water from the New River, which twists through the 4,000-acre plant tract in an S-curve, is satisfactory for

powder making after rapid, simple filtration. Drinking water will receive more elaborate treatment in a small plant adjacent to the large installation for process water. Work on the pumping station, water mains and treatment plants has been pushed forward rapidly along with the other basic utility, the power house.

Material Requirements

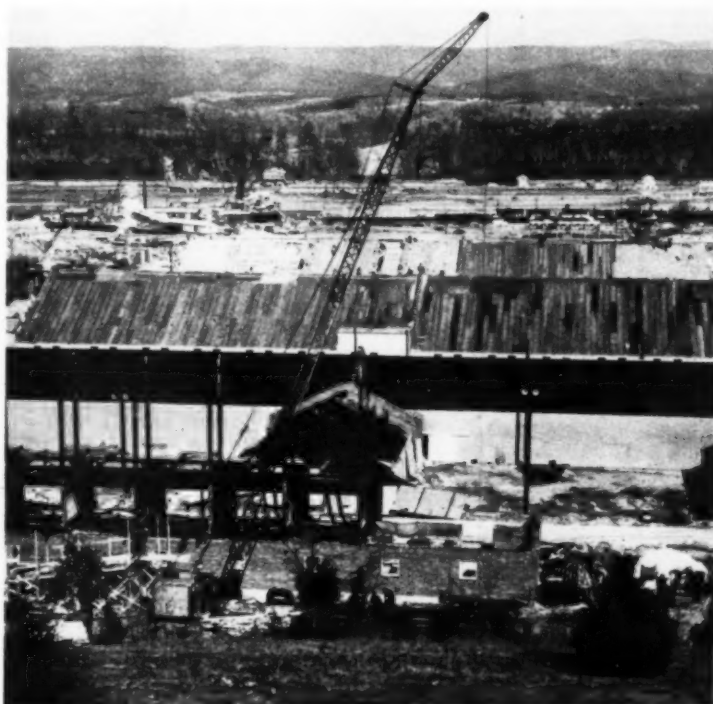
Quantities of materials and volume of work required for the project are barely suggested by the brief table of estimates published with these notes. Efficient purchasing and expediting personnel maintains steady deliveries of materials and equipment to meet scheduled construction requirements and forestalls delays on such items as lumber, on which deliveries have been extremely slow, by placing advance stock orders for 2,000,000 ft. b.m. at a time. Crushed limestone aggregate for roads and for concrete is consumed by the job at a rate of 3,500 tons per day. The stone comes from three sources, 1,000 to 1,500 tons being delivered by trucks and the remainder by rail, as stipulated to avoid highway congestion. Additional stone is required for ballasting 12 mi. of plant tracks.

Plant Site

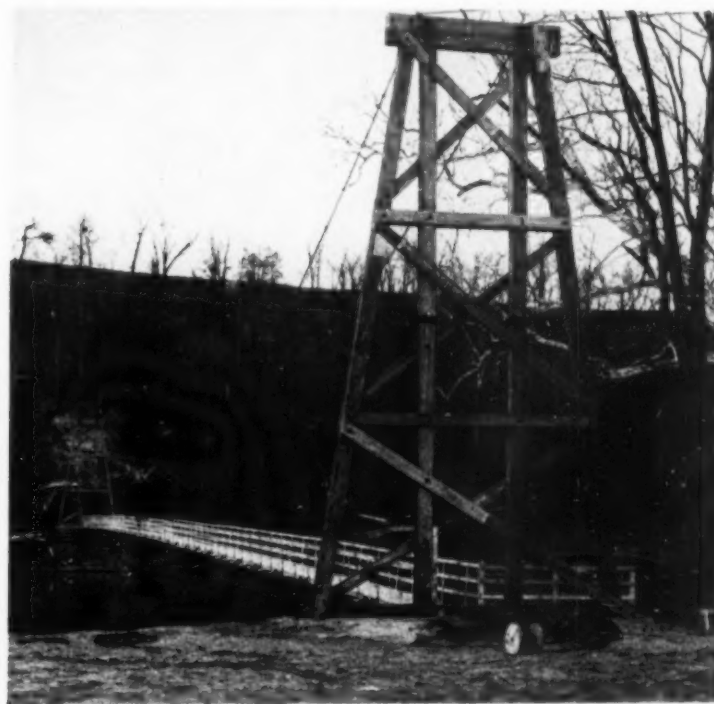
Location of the Radford Ordnance Works on the New River in the foothills of the Allegheny Mountains fits all the primary requirements of a smokeless powder plant: access to sources of cotton linters and good steam coal, desirable climatic conditions, ample water of good quality, an adequate supply of native labor, connections to two railroads (the Norfolk & Western and the Virginian) and a relatively level site which does not call for excessive grading. An example of the Army's careful advance planning for the Radford and other ordnance works is the fact that the site had been studied for several years before Congress passed the act to expedite construction (signed by the President on July 2, 1940), and a tentative decision to use the location had been made by the Ordnance Department as the result of an inspection in September, 1939. It is hardly accurate to describe the site as level, although the building areas are sufficiently so; elevations above sea level on the 4,000 acres range



HIGH-SPEED CONSTRUCTION of \$41,000,000 Government-owned nitrocellulose smokeless powder plant near Radford, Va., is scheduled to permit manufacturing to begin 10 months after signing of original contract with Hercules Powder Co. on Aug. 16, 1940. Time required for completion of power house, in center, determines earliest possible date for plant operation. First powder line actually goes into production three months ahead of schedule.



ONE OF THREE POWDER LINES stretches into distance from brick-walled nitrating house in foreground, where long-boom crane is handling steel for frame to support nitration process equipment.



SUSPENSION BRIDGE with main span nearly 550 ft. long provides temporary pedestrian crossing of New River for construction workmen.



LUMBER STOCKS on project avert delays in delivery of 7,500,000 bd. ft. for 600 plant buildings. Of this amount, 5,000,000 bd. ft. is salt-treated lumber to resist acid fumes.



PRIMARY RESPONSIBILITY for all activities connected with construction and eventual operation of Radford Ordnance Works rests with (left to right) LT. COL. M. M. SERREM, Ordnance Department, U. S. Army, Commanding Officer and Constructing Quartermaster for War Department; H. V. CHASE, manager for Hercules Powder Co.; and A. VAN BEEK, assistant manager.

Photo by Lambert Martin
© Roanoke World-News



ADMINISTRATIVE OFFICER in charge of War Department office on project is MAJ. GEORGE F. GRIFFITH, who puts his previous construction experience to good use on this job.

Photo by Lambert Martin
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AS PROJECT ENGINEER in charge of construction for Hercules Powder Co., P. F. POWELSON keeps his finger on pulse of progress.



ASSISTANT PROJECT ENGINEER for powder company is P. B. PATTERSON.



PLANT POLICE operate under direction of CAPT. D. J. PAYNE.



GENERAL MANAGER and vice-president of Mason & Hanger Co., subcontractor for general construction on project, is G. W. SACKETT.



CONSTRUCTION WORK on project is directed for Mason & Hanger Co. by ROBERT L. TELFORD, general superintendent.



CONSTRUCTION ACTIVITIES are special responsibility of Major F. L. STRAWN who served as constructing quartermaster until appointment of commanding officer for project.

from 1,685 ft. at the river to 2,000 ft. or more on the hilltops. Buildings in the production lines are laid out to permit downhill delivery from one unit to the next.

Powder-Making Process

Manufacturing operations involved in the making of smokeless powder are indicated in a general way by an accompanying flowsheet reproduced from one of the War Department's technical manuals. General construction features of certain plant buildings, somewhat different from the ordinary, are shown in a following section, although exact identification of some structures is

RADFORD ORDNANCE WORKS ESTIMATED CONSTRUCTION QUANTITIES (Partial List)

	Total For Job
Excavation	1,000,000 cu.yd.
Concrete	70,000 cu.yd.
Sewer Lines	10 miles
Water Lines	80 miles
Solvent Lines	10 miles
Steam Lines	20 miles
Roads	15 miles
R.R. Track	12 miles
Lumber	7½ million b.ft.

withheld. Regarding permanent powder-making machinery installed in the buildings, nothing may be said.

Another succeeding section gives due recognition to the officers, managers, and engineering and administrative personnel responsible for the rapid progress of plant construction. Apart from the project staff, Ordnance Department officers whose names should be mentioned, because of the pre-planning and pre-stocking of essential equipment by these men, include Brig. Gen. Charles T. Harris, Jr., Assistant Chief of Ordnance in charge of production; Brig. General Levin H. Campbell, in charge of building facilities; and Maj. John P. Harris.

2... Organization and Personnel

Job Management and Labor Supervision Speed Powder Plant Construction

SKILLED MANAGEMENT and effective organization, represented by accompanying charts and photographs, spell the measure of success in pushing the \$41,000,000 Radford Ordnance Works, in Virginia, through to completion within the 10 months originally set, despite added handicaps such as revision of the layout of plant buildings and supplemental inclusion of a third powder line to increase capacity originally planned. The Hercules Powder Co. is general contractor for construction and operation of the Government-owned plant. During the construction period more than 21,000 workers have been employed at the site; of this number the powder company has about 5,000 men on the payrolls of mechanical subcontractors engaged in erection, assembly and installation of powder-making facilities and utilities requiring special experience and close supervision. After the plant goes into full operation early in the summer, the powder company will employ from the surrounding territory approximately 4,500 persons, 10 per cent of whom will be skilled personnel at present receiving training in established plants of the contractor.

Construction Staff

General construction work is assigned to a subcontractor, the experienced Mason & Hanger Co., of New York, which employs a payroll of nearly 13,000 and operates most of the 1,000 equipment units on the job. An accompanying chart gives a complete breakdown of the Mason &

Hanger organization. This organization works in cooperation with, and under the direction of, the project staffs assigned to the job by the War Department and the powder company. Top members of all three agencies appear in photographs reproduced on these pages. In complete charge of the entire project as representatives of the government are Ordnance Department officers headed by Lt. Col. M. M. Serrem, who acts both as Commanding Officer and Constructing Quartermaster. The facilities of the Quartermaster Corps are at the disposal of the Ordnance and other Army departments on new construction.

Labor Rates

Construction labor works three shifts a day, each shift putting in 48 hr. per week to keep the job operating a full 24 hr. six days a week. Equipment main-

tenance and special jobs require Sunday overtime work by a small force. The men receive straight time for 40 hr. and time-and-a-half for overtime. Minimum wage rates for skilled labor are based on the scale of the Roanoke, Va. Building Trades Council, A.F.L., and are established for the contract by the U. S. Department of Labor after approval by the War Department.

A rate of \$1.25 an hour is paid boiler-makers, bricklayers, stonemasons and operators of power shovels, cranes and double-drum hoists.

For carpenters, plumbers, reinforcing rod setters and steamfitters, the rate is \$1.00.

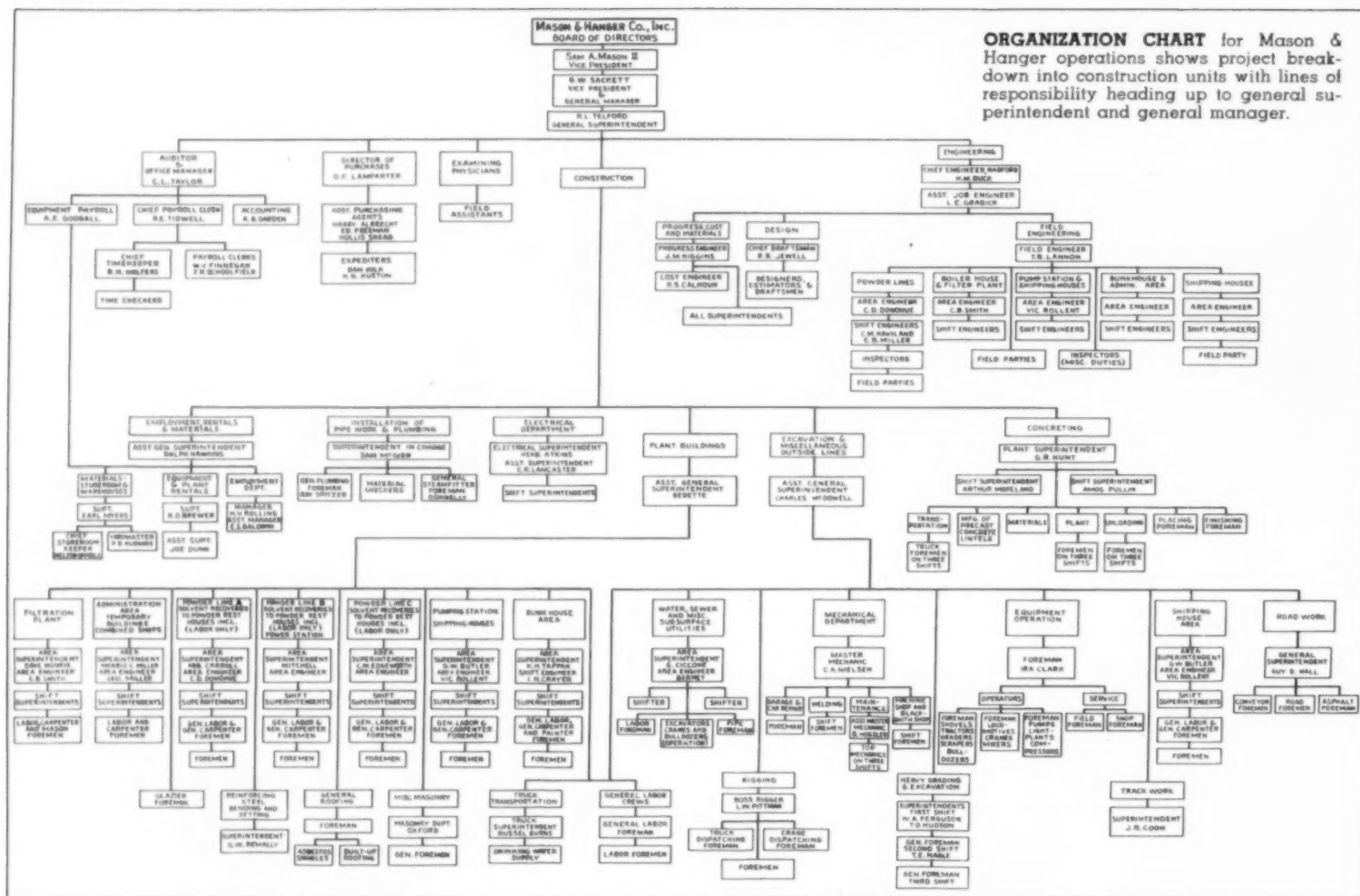
Cement finishers, metal lathers, plasterers, structural iron workers, terrazzo workers and tile setters receive \$1.10 per hour.

Tractor operators have a rate of 50c. an hour, and truck drivers, 40c. Rates of other crafts are in the range of those listed. The common labor minimum rate is 35c. an hour. Subcontractors operate open or closed shop in accordance with their own labor policies.

No difficulty has been experienced in procuring skilled labor for the project. The bulk of the labor (75 to 80 per cent) has been obtained within a 50- to 75-mi. radius of Radford, which taps the borders of West Virginia and Tennessee. Practically all the remaining labor has been recruited within a range of 100 mi., including portions of Kentucky and North Carolina. When additional

RADFORD ORDNANCE WORKS—EMPLOYED PERSONNEL For day ending January 21, 1941

	ADMINISTRATIVE (SALARY PAYROLL)			Mechanics & Laborers on Project	Total Personnel	
	Project Site		Other Locations			
	Male	Female	Male	Male	Male	Female
HERCULES POWDER CO.	801	86	89	3,932	4,822	86
MASON & HANGER CO.	731	107		8,467	9,198	107
Total Contractors	1,532	193	89	12,399	14,020	193
GOVERNMENT	331	34			331	34
TOTALS	1,863	227	89	12,309	14,351	227
GRAND TOTAL					14,564	



labor is required, the contractor calls upon Federal Government agencies, union trades councils and chambers of commerce such as the one in Bluefield, W. Va., sends out runners or puts a call on the radio.

Of the 13,000 men employed by the Mason & Hanger Co., about 8,000 work on the 8 a.m. to 4 p.m. shift, 4,000 on the second shift, and 1,000 on the graveyard shift. Convenient railroad transportation is provided for workers out of Roanoke and Bluefield by agreement between the contractor and the Norfolk & Western. About 5,000 workers ride the trains, the remainder commuting from their homes by automobile. Four trains a day operate out of Roanoke, 42 mi. away, two sections for the day shift and two for the evening shift returning. One train for the day shift makes the round trip from Bluefield, 57 mi. distant. Passengers are charged 25c. per round trip from Roanoke and 40c. from Bluefield. The contractor makes up any deficit in the train cost agreed upon with the railroad. Practically all dwelling facilities, including many trailer camps, within a 20- to 25-mi. radius have been taken by workmen who have moved in from a distance.

Employment Procedure

Job seekers are interviewed and examined at a complete employment office outside the 6-ft.-high barb-topped non-climbable Cyclone woven-wire fence, 18 mi. in length, which protects the plant

AM, FRIDAY, MARCH 14, 1941.

Army Dedicates Big Powder Plant

Beats Schedule Three Months

By the United Press.

RADFORD, Va., March 14.—The War Department dedicated a \$44,100,000 smokeless powder plant today three months ahead of schedule. It is the first of a chain of 40 munitions factories for the "arsenal of democracies."

Defense leaders, Congressional, state and industrial officials joined the 18,000 workers who built the plant for the ceremonies. A special train brought an official party of 80 from Washington, headed by Undersecretary of War Patterson.

Designed to provide "unusual protection" against explosion or attack by planes, the plant begins partial operation next week. By early summer it will be turning out 300,000 pounds of powder daily.

Powder is a major shortage. The Radford plant's annual production of 110,000,000 pounds will more than compensate for the loss resulting from the explosion which destroyed the powder plant at Kenvill, N. J. Two similar factories are being constructed at

area on all sides not cut off by the river. Two reception offices are equipped for interviews. Acceptable applicants receive thorough physical examinations, and those who pass the tests for employment are photographed and fingerprinted by a department under the direction of Capt. D. J. Payne, who heads the plant police force, with headquarters in the employment office building. Before entering the plant area for the first time, the new employee is issued a badge bearing his photograph; employees are required to wear their badges at all times while inside the fence, as well as when entering and leaving. The project maintains a staff of six physicians, three at the employment office and three at a first aid station.

In January the plant police force numbered 114 men, equipped with motorcycles, cars and station wagons, two of the latter carrying loudspeaker apparatus for directing crowds or congested traffic and for giving warnings. According to Captain Payne, this force represented less than half of what it was going to be later. Along with their important duties of manning all gates, maintaining peace and order and guarding against intruders, the police have charge of traffic and post traffic officers at all important intersections. A visitor to whom the War Department grants a pass into the plant cannot remain there an hour without being impressed by frequent challenges from vigilant police patrols.



UPSTANDING POLICE PERSONNEL and first-rate police equipment are represented by this assemblage, with CAPT. D. J. PAYNE in center.



PRESSURE DRINKING FOUNTAIN equipped with small air pump has 5-gal. capacity. Metal tank is carried by adjustable strap on shoulder of "water boy."



LONG PASSENGER TRAIN stands on plant track from 4 p.m. until leaving time to take on 17 cars of workers bound for Roanoke.



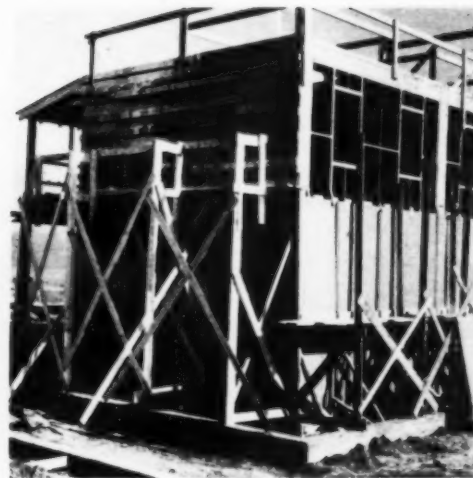
LOUD SPEAKERS set up at various locations on 4,000-acre project carry announcements to all workers.



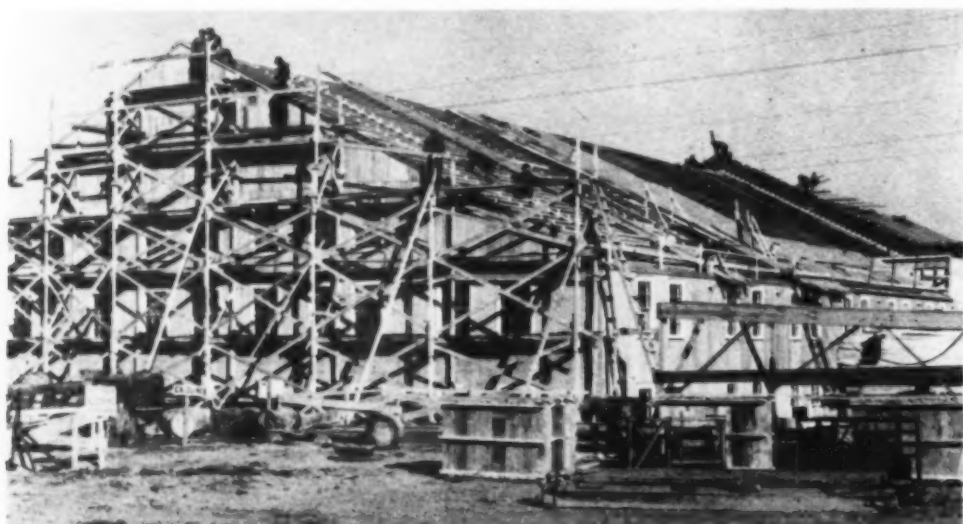
JOB SEEKERS congregate outside employment office from before sunup until 4 p.m., when doors close.



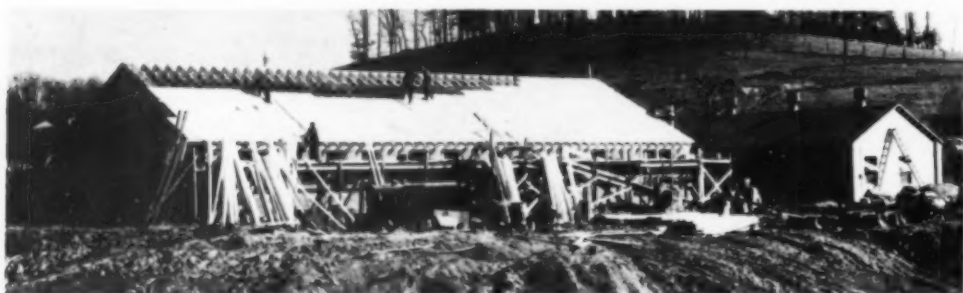
GIN POLE and trussed pick-up frame place curved plates for riveted steel acid tanks.



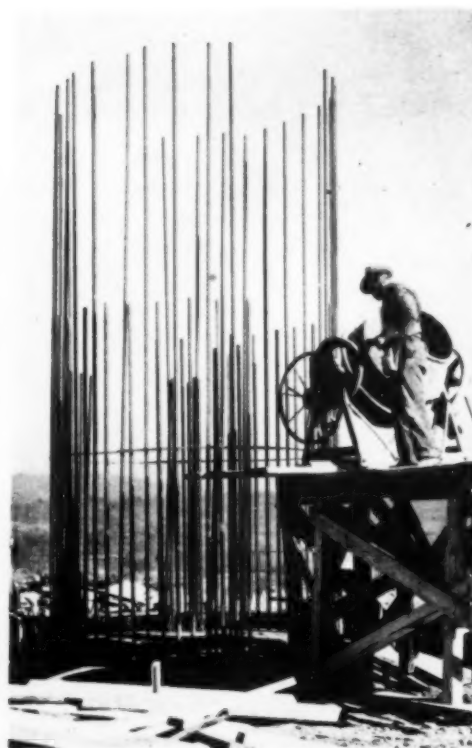
CORRUGATED ASBESTOS-CEMENT SIDING incloses sidewalls of solvent recovery building. Partitions are solid concrete in lower part and gypsum concrete between gypsum board liners in upper part.



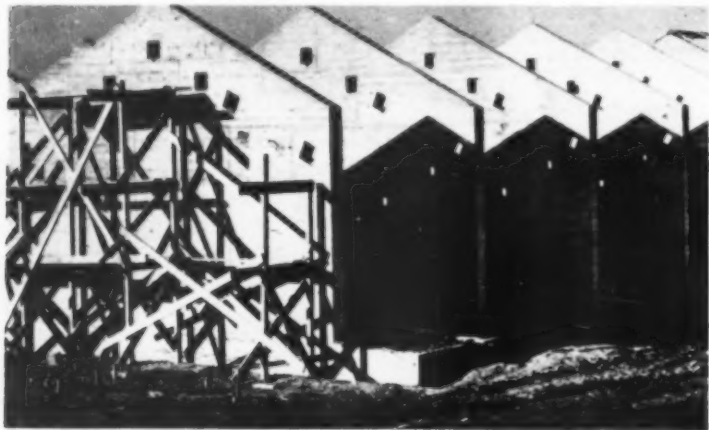
SALT-TREATED TIMBER goes into roof frame and sheathing of large boiling tub houses covered with 20-year bonded built-up roofing. Walls are inclosed with galvanized steel sheets.



CINDER-BLOCK WALLS are used for powder line office building, receiving roof sheathing, and brick walls for change house, with roof ventilators, where plant operatives will change clothes at beginning and end of shift.



ON HILLTOP, Rust Engineering Co., subcontractor, starts reinforced-concrete fume stack 200 ft. high, with inside diameter at base of more than 7½ ft. and wall thickness of nearly 16 in. Second fume stack is 1 ft. smaller in diameter.



SOLID CONCRETE PARTITIONS (left and right) and corrugated asbestos-cement siding and roofing are characteristic of dehydrating buildings, where moisture is pressed and driven out of nitro-cotton.

For use during the construction period, the contractor made a temporary installation of the permanent plant broadcasting system, with amplifiers set up in elevated positions at many points in the area to make the announcer's voice audible to all workers. The loudspeaker system broadcasts warnings of unsafe driving conditions on highways (advising drivers, when necessary, to put on chains before starting home), admonishes motorists to exercise care at times of congestion when shifts are leaving, makes important announcements such as additions to train schedules, and carries occasional "pep talks" to inspire the workers with need for earnest effort in a national emergency. From the microphone station in

the central office building of the Mason & Hanger Co., the announcer can see nearly all of the roads leading away from the plant and can admonish reckless drivers and trains of vehicles individually. Philip Cooke, editor of the Radford Plant Weekly published by Hercules and Mason & Hanger, has a good radio voice and makes nearly all of the broadcasts.

Mess Halls

Lunches are brought to the job by most of the workmen, but two mess halls serving hot 30c. dinners are operated at the site by W. F. Griffin, of Griffin Industries, Fort Bragg, N. C. One hall seats 200 diners, and the other, 400. Permanent mess halls are provided.

Semi-Weekly Meetings

Twice a week construction management representatives of the Army, the contractor and all subcontractors meet in the office of the commanding officer to discuss matters affecting job progress, to establish working schedules and materials requirements for the future and to iron out difficulties. These meetings mapped out the coordinated overall plans which smoothed the progress of the work and made possible the cooperative action necessary for speedy construction. Any lag in progress or equipment utilization was brought up for attention at the meetings and the causes of possible delays were promptly diagnosed and remedied.

3...Powder Plant Buildings

Powder Manufacture Requires Special Type of Structures

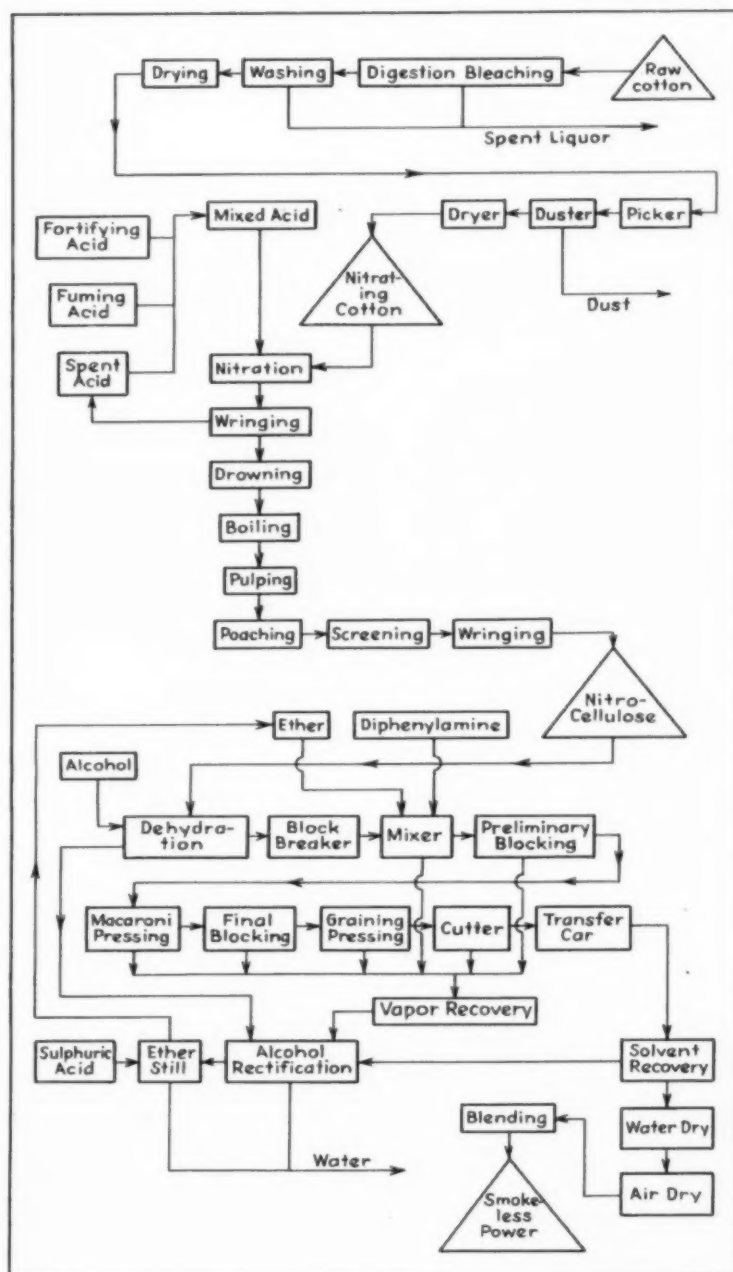
SMOKELESS POWDER is a powerful propellant for projectiles, as any ordnance officer or explosives expert will testify, and its propellant properties develop fairly early in the manufacturing process. Skilled design and operation of a smokeless powder plant form an almost perfect safeguard against undesired and unexpected release of this propellant energy during the process of manufacture; but as a logical added precaution, dictated by experience, the buildings of the Radford Ordnance Works in Virginia are so constructed, spaced and protected as to localize an explosion and minimize its effects. Construction for these purposes introduces features which are not found in ordinary buildings. Photographs reproduced with various sections of this article show some of the unusual structural characteristics.

A glance at the accompanying flowsheet for the manufacture of smokeless powder will show that cotton linters go through a preliminary processing before the cotton is ready for nitrating. These operations are accomplished at another plant; the cotton will arrive at the Radford Ordnance Works in closed containers ready for processing into smokeless powder.

As indicated by the flowsheet, the first of the manufacturing operations is ni-

tration, in which the cotton is stirred in a mixture of nitric acid and sulphuric acid to produce cellulose nitrate. The nitro-cotton and acid drop into a centrifugal wringer which removes the spent acid. In general, it may be said that each of the succeeding operations is performed in a separate building. As a matter of fact, most operations in each of the three powder lines are distributed among several buildings. Lumber used in buildings where acid fumes are released is protected by salt treatment, either zinc chromate or Wolman, the project taking all it could obtain of both processes to make up the 5,000,000 b.ft. required.

Transfer of the cellulose nitrate, or pyrocotton, between buildings from nitration to the final wringing which prepares the pyrocotton for dehydration by alcohol is through pipe lines, the material being suspended in water. In this condition the danger of explosion is nil. Pyrocotton from the wringers contains less than 30 per cent moisture; once dehydration is begun in presses which operate at pressures up to 3,500 lb. per square inch the cellulose nitrate is in a relatively dry state susceptible to explosion, and this fact is taken into consideration in the design and spacing of buildings for the remaining operations. The pictures show safety features.



FLWSHEET for manufacture of smokeless powder.

4... Construction Equipment

Close Supervision Reduces Idle Time in Equipment Operation

TO SUPPLY nearly 1,000 construction equipment units needed to complete the \$41,000,000 Radford Ordnance Works in Virginia, the Army, Hercules Powder Co. and Mason & Hanger organizations have combed manufacturer, distributor and contractor sources for quick rental or purchase of the required machines. Nearly 700 units have been rented under a significant War Department contract arrangement which establishes an agreed-upon value for each machine when delivered and gives the Government an option to take over the piece of equipment at this valuation, with the added provision that the purchase may be consummated (at any time during the unit's retention) at the established price plus 1 per cent per month for the intervening rental period. Rentals are based on the Cost Of Equipment Ownership schedule of the Associated General Contractors of America ranging generally from 7 to 10 per cent per month of the first cost of the equipment. As can be seen from the contract provisions previously elucidated, all of the rental payments, save 1 per cent per month, may be applied toward the take-over price agreed upon between the lessor and the War Department.

In actual practice, equipment requirements for the job are determined by the Hercules Powder Co., contractor, or even more generally and directly by the Mason & Hanger Co., subcontractor for general construction and largest user of equipment on the project. All requisitions, however, are subject to approval by the commanding officer, and all rental agreements are between the War Department and the owner of the equipment. Because of the close, harmonious collaboration of the contractor agents and the Army staff on the project, this arrangement offers no impediment to swift execution of requisitions.

Equipment Supervision

After equipment has been placed on the job, the War Department representatives (officers of the Ordnance and Quartermaster Departments) and the contractors maintain constant

supervisory control to reduce idle time to a minimum. An idle machine is regarded as a miscreant whose sloth is delaying the job, and equipment caught loafing by Army or contractor checkers who roam the project is promptly reported and as quickly as possible dispatched to a section where it may be put to use. On a 24-hr.-per-day job, with considerable variation in the size and capacities of the three shifts, it is not feasible to keep all equipment operating continuously. Allowance, too, has to be made for layoffs when repairs are necessary, although ordinary maintenance is taken care of during the 24-hr. Sunday shutdown by mechanics regularly or specially assigned to the work.

Col. M. M. Serrem, commanding officer, and his construction aides have set an arbitrary standard of 50 per cent operating time as the proper level of efficiency in utilization of all equipment. Daily reports of rental equipment operation are submitted to the commanding officer, and a weekly analysis is made up to summarize the daily data. Typical examples of both daily and weekly reports are shown on these pages. In the weekly report, operation of machines at more than 50 per cent of capacity during the eighteen-shift (144-hr.) work week is considered satisfactory and is indicated in the final column merely by the letter M. For equipment falling below the 50 per cent standard, the final column shows actual percentage of operating capacity utilized during the week.

DAILY REPORT OF RENTAL EQUIPMENT OPERATION

January 14, 1941

DESCRIPTION	Number of Units	Possible Machine Shifts	Broken Down Machine Shifts	Idle Machine Shifts	Shifts Machine Worked
Buckets & Clamshells	18	54	0	45	9
Bulldozers	17	51	6	10	35
Carryalls	9	27	0	7	20
Compressors	30	90	0	52	38
Conveyors	11	33	3	19	11
Cranes	12	36	0	12	24
Ditchers	4	12	0	9	3
Drills	2	6	0	2	4
Drills, Wagon	9	27	0	19	8
Drills, Well	1	3	0	3	0
Dumptors	7	21	5	1	15
Graders	8	24	3	10	11
Hoists	6	18	0	16	2
Hoppers & Scales	2	6	0	0	6
Lighting Units	64	192	0	69	123
Machine Shop Equip.	10	30	0	0	30
Material Bins	2	6	0	3	3
Mixers	17	51	0	42	9
Passenger Sedans	1	3	0	2	1
Passenger Station Wag.	9	27	0	15	12
Power Brooms	3	9	0	7	2
Pumps	9	27	0	26	1
Railway Engines	1	3	0	0	3
Railway Flat Cars	2	6	0	4	2
Rollers	12	36	2	25	9
Rollers, Sheepsfoot	4	12	0	8	4
Rooters	3	9	0	5	4
Scrapers (other than Carryalls)	20	60	0	28	32
Shovels, Power	17	51	0	18	33
Stone Spreaders	1	3	0	2	1
Tanks, Air Receiving	2	6	0	5	1
Tanks, Fuel	1	3	0	0	3
Track Wagons	16	48	0	17	31
Trac-Truks	5	15	0	8	7
Tractors	26	78	6	15	57
Tractors, Caterpillar	28	84	18	15	51
Truck & Trailer	3	9	0	6	3
Trucks, Dump	115	345	18	109	218
Trucks, Flat	34	102	17	32	53
Trucks, Linesman	4	12	3	4	5
Trucks, Mixer	14	42	7	9	26
Trucks, Pickup	41	123	3	40	80
Trucks, Rack	27	81	0	21	60
Trucks, Tank	2	6	3	0	3
Trucks, Winch	4	12	3	4	5
Welders	15	45	6	3	36
TOTAL	648	1,944	103	747	1,094

EQUIPMENT UNITS listed in these daily and weekly reports represent less than 70 per cent of total number (nearly 1,000) of construction units in operation on project.

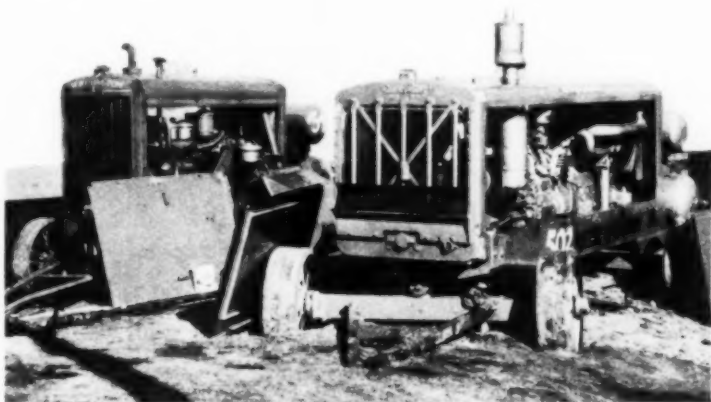
Value of Equipment

Less than 70 per cent of the total number of equipment units on the job is represented in the rental equipment operation reports. Total value of all construction equipment as delivered to the job (take-over value or equivalent) is conservatively estimated at \$2,000,000. The agreed-upon value of 370 of the heavier units amounts to \$1,500,000. Monthly rental paid on equipment shown in the rental reports is \$160,000.

Heavy equipment units proved the most difficult to obtain. Earth-moving equipment was brought in from the Blue Ridge Parkway and the Pennsylvania Turnpike, where Mason & Hanger had completed one of the tunnels. The War Department does not permit transportation to be paid for more than 500 mi. on rental equipment. New equipment proved hard to get. On an order for two crawler cranes the Mason & Hanger purchasing agent inquired of two manufacturers on whose equipment the company had more or less standardized; the one source needed too much time for delivery, and the other could accept no orders for cranes. The construction company then bought two good machines from a third manufacturer who



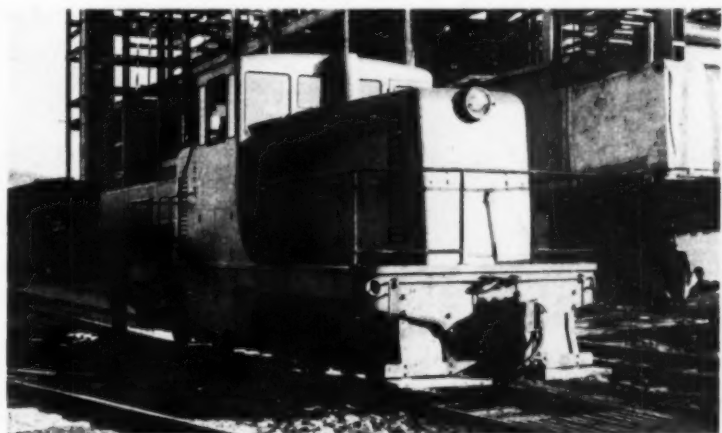
TRUCK MIXERS of 4-yd. capacity deliver 3-yd. concrete batches from central plant to scattered locations. Pneumatic-tired carts, equipped with rockers for dumping, transport concrete over runways from truck mixers to forms.



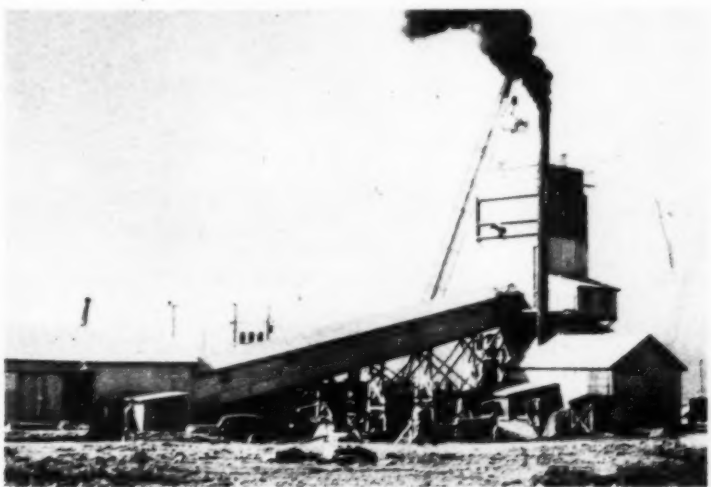
PORTABLE COMPRESSORS of 315-c.f.m. capacity, hooked up in pairs, are typical of 30 or more compressor units serving construction subcontractor on job.



TWO OF 29 SCRAPER UNITS on job make roadway cut in plant area. Two types shown here represent 60 per cent of all scraper outfits on project.



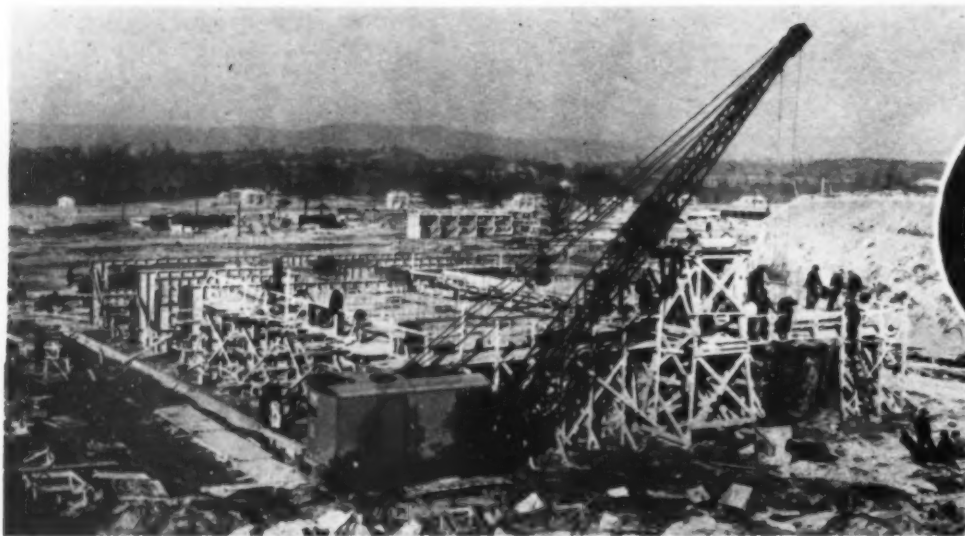
PERMANENT SWITCH ENGINE for powder plant is diesel-electric locomotive which serves during construction to move materials cars.



CONCRETE MIXING PLANT receives sack cement by inclosed 110-ft. belt conveyor from storehouse. Crane with 85-ft. boom feeds 250-yd. aggregate bins with 1½-yd. clamshell bucket.



FOUR WAGON DRILLS sink blast holes for 15,000 cu. yd. of rock excavation in highway cut of maximum 60-ft. depth approaching site of permanent bridge across New River connecting two plant areas.



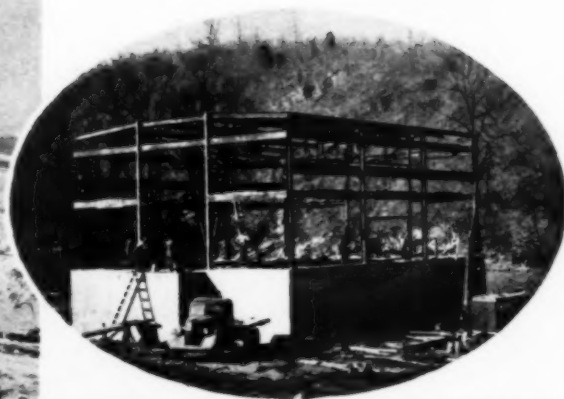
TYPICAL CONCRETING SET-UP for construction of dividing walls in processing building utilizes crane, bottom-gate bucket, elevated hopper and pneumatic-tired cars to move concrete from truck mixers to forms built up of prefabricated panels.



CANVAS HOUSING protects concrete in filter beds during cold weather. Coke-burning salamanders maintain even temperature inside inclosure.



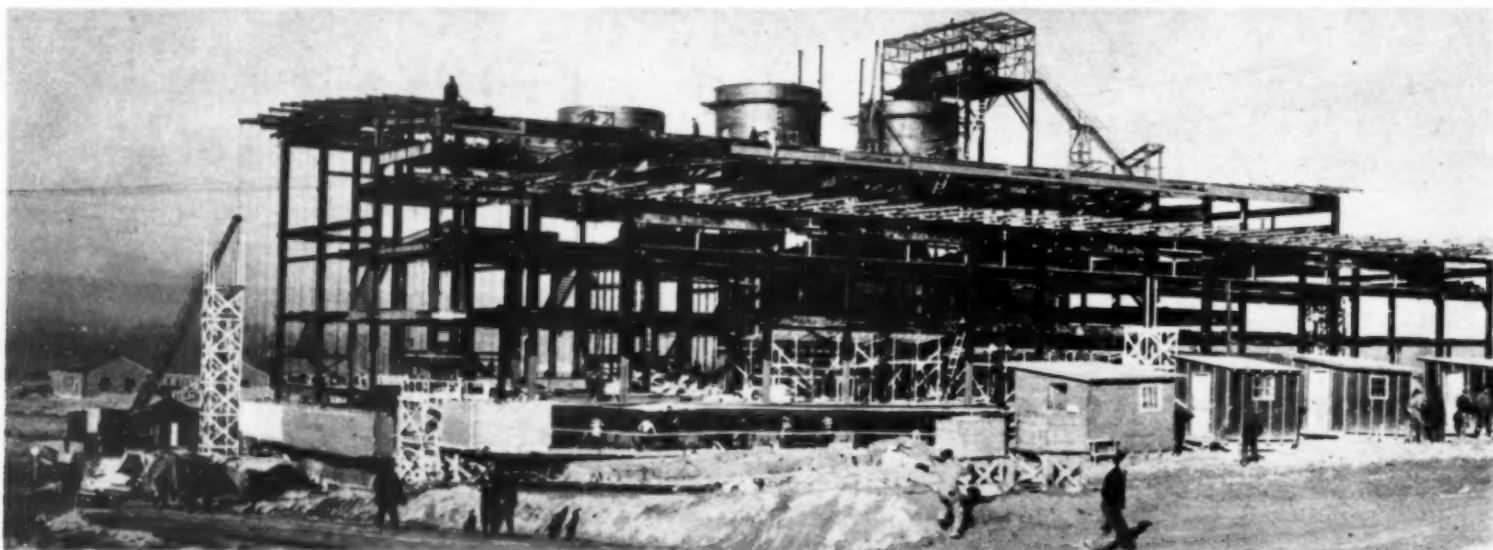
STEAM AND SOLVENT LINES are supported above ground on timber bents, typical of plant construction in process industries.



PUMP HOUSE being rushed to completion at river's edge is steel frame structure on concrete foundation walls.



WATER MAIN of 36-in. steel pipe is laid in trench upgrade from pump house to filter plant. Pipe comes in 40-ft. lengths, lined on inside with bituminous enamel and wrapped on outside with 1/16-in. thickness of asphalt-impregnated paper covered with whitewash.



GOVERNING FACTOR in construction progress on powder plant is power house designed to inclose four 7,500-hp. coal-fired boilers and as many turbo-generators. Bricklayers working on hanging scaffolds build up closure walls. Structure rests on spread footings of 4,000 lb. per square foot bearing, which is soil loading value used for all spread footings on project.

was able to make prompt job delivery.

To move 1,000,000 cu.yd. of excavation, 15 per cent of it rock, Mason & Hanger have operated a large number of units: about twenty power shovels, $\frac{3}{4}$ to 2 yd., gasoline and diesel, many convertible to cranes and backhoes, mostly Bucyrus-Erie, Lorain and Marion; 28 carrying scrapers, 12 to 17 yd., Le Tourneau, Gar Wood, Bucyrus-Erie, Austin-Western and Adams; more than 50 tractors, 30 to 108 hp., mostly diesel, Caterpillar, Allis-Chalmers, Cletrac and International; fourteen track wagons, Athey, Euclid and La Plant-Choate; a Linn crawler-traction truck; four Euclid pneumatic-tired tractor-truck units; seven Koehring 6-yd. diesel Dumpsters from the Pennsylvania Turnpike job, and scores of dump trucks. Nine Ingersoll-Rand wagon drills, more than 30 portable compressors (many of the same manufacture) and a large number of hand-held drills have been used on the rock work.

In addition to converted shovels, the job employs seven or eight full-time backhoes, Byers, Northwest and Bucyrus-Erie. Ditches are cut by five ladder-type trenching machines, Parsons, Buckeye, Barber-Greene and Austin-Western. Grade is struck off by Adams, Austin-Western, Allis-Chalmers and Caterpillar motor patrols. Stone base and bituminous top for roads and parking areas, of which seven or eight are provided outside the fence to accommodate about 2,500 cars, are compacted by a dozen flat rollers, Hercules, Galion, Austin-Western and Buffalo-Springfield.

Earthmoving operations have been able to proceed at full capacity about 16 days of each month, weather and job conditions ordinarily causing holdups on the other 10 working days. On some days the earthmovers accounted for 50,000 to 60,000 yd., and the outfit rang up a peak output of 75,000 yd. for one day. The daily and weekly reports of rental equipment operation give a fair picture of the percentage of working time utilized by earthmoving units.

For concrete delivery to 600 buildings

WEEKLY ANALYSIS OF RENTAL EQUIPMENT

Working Less Than 50 Per Cent of Capacity
Based on 18 Shifts, 6 Days, Jan. 1 to
Jan. 7, Inclusive

(M means more than 50 per cent)

DESCRIPTION	Number of Units	Percentage of Capacity Utilized
Buckets and clamshells	19	18
Bulldozers	17	M
Carryalls	9	42
Compressors	27	45
Conveyors	11	37
Cranes	12	M
Ditchers	3	24
Drills	2	M
Drills, wagon	9	39
Drills, well	1	6
Dumpsters	7	16
Graders	7	34
Hoists	6	11
Hoppers & scales	2	M
Lighting units	58	M
Machine shop equipment	10	M
Material bins	2	M
Mixers (mostly mortar)	17	24
Power brooms	3	6
Pumps	9	7
Railway locomotive (steam)	1	M
Railway flat cars	2	33
Rollers, sheepsfoot	4	14
Rollers	12	11
Rooters	3	7
Scrapers (other than Carryalls)	20	48
Shovels (power)	13	M
Stone spreader	1	11
Track wagons	16	M
Trac-Truks	5	32
Tractors	26	M
Tractors, Caterpillar	27	M
Trucks and trailers	2	36
Trucks, dump	114	M
Trucks, flat	31	M
Trucks, linesman	4	36
Trucks, mixer	14	M
Trucks, pickup	41	M
Trucks, rack	27	M
Trucks, tank	2	M
Trucks, winch	4	46
Welders	10	M
TOTAL	610 units	

and other structures scattered over 4,000 acres, the construction subcontractor uses a central mixing plant, equipped with two Ransome 28S mixers, and operates from this plant fourteen 4-yd. truck units hauling 3-yd. batches for distances up to $1\frac{1}{2}$ mi. in the main plant area, with longer hauls in prospect. The fleet comprises thirteen Jaeger mixers on International trucks and one Ransome mixer. Concreting equipment is in continuous operation 24 hr. a day; in the three shifts the truck mixers may deliver to 30 or 40 locations. Peak output for the plant has been 1,100 cu. yd. in 24 hr., representing a good chunk of the total estimated requirements of 70,000 yd. for the job.

At the mixing plant, 250-yd. Butler aggregate bins are charged by a Marion crane handling a $1\frac{1}{2}$ -yd. clamshell bucket on an 85-ft. boom. During cold weather, the aggregates are heated by live steam in the bins, and hot water is used for mixing. An inclosed belt conveyor 110 ft. long carries sacked cement from the storehouse up to the batching platform. Blaw-Knox and Butler weight batchers measure the stone and sand for the two 1-yd. mixers.

Stone Sand

Crushed dolomite sand similar to that used in the Radford hydro-electric development of the Appalachian Electric Power Co., reported in CONSTRUCTION METHODS, April, 1939, pp. 40-43, provides the fine aggregate for all the concrete. Using this well-graded, manufactured sand, the constructors are getting high concrete strengths with a low cement factor. In standard 5-sack mixes, cylinder tests for the job have given compressive strengths of 2,200 to 2,500 lb. per square inch at 7 days and have averaged 3,000 lb. at 28 days. All concrete is vibrated internally after it is placed in the forms. The concrete gangs use about ten portable vibrators, Jackson and Viber gasoline or gasoline-electric units and air-powered vibrators of Ingersoll-Rand or Chicago Pneumatic Tool Co.

5... Utilities

Constructors Move Fast to Provide Steam, Power, and Water for Powder Making

MANUFACTURE OF HUGE QUANTITIES of smokeless powder at the Radford Ordnance Works in Virginia will require more than 15 m.g.d. of water, an abundance of steam for processing and a large amount of electric power to drive air compressors and hydraulic pumps which furnish safe power for use inside the processing buildings. The power lines cannot operate until the steam power house and water supply are ready to function, and the time required for

completion of these utilities, particularly the power house, established the 10-month limit set by the War Department in its original contract with Hercules Powder Co., builder and operator of the government-owned plant. Erection of the power house is being rushed by the contractor with the aid of subcontractors such as the Combustion Engineering Co. for boilers, the Allis-Chalmers Mfg. Co. for turbo-generators and the Mason & Hanger Co. for general

structural work. The last named company, principal subcontractor for general construction of the plant, is doing practically all the work on the water supply development, which involves a pump house beside the New River on the site, a 36-in. steel pipe water main to the filter plant, separate treatment units for process water and drinking water, and a distribution system.

Steam developed by four 7,500-hp. boilers will serve two purposes. High-

pressure steam will be scalped to run the turbine generators hooked up to the boilers, and the low-pressure steam from the turbines will be used for processing. The fourth unit is a standby unit and comprises a boiler and turbo-generator of equal capacity.

Test borings to determine the presence of any caverns in the limestone under the power house went down 50 ft. before striking sound rock, and the power house is carried on a spread footing designed for a bearing of 4,000 lb.

per square foot, the same loading as used for the footings under most of the plant buildings. A connection with local public utility lines provides another source of electric power for the plant, if needed.

Construction of other utilities such as railroad connections and plant track, highways, sewers, and light and power lines presents no obstacle to swift completion of the plant. Steam and solvent lines are carried above ground and are run into the buildings as soon as the

structures are ready for interior work.

Accompanying photographs afford a general view of the materials and equipment being employed in construction of utilities. One major structure, not shown, is a highway bridge across the New River connecting one 2,500-acre area to a second 1,500-acre area acquired later. This bridge, now under construction, has steel girder spans up to 165 ft. in length on concrete piers and abutments. One pier is in the river.

6... Night Work

Skid Light Plants Furnish Illumination for Two Night Shifts

SIXTY PORTABLE LIGHT PLANTS mounted on welded tubular skids carrying steel masts for floodlamps provide a large share of the illumination required by the 5,000 men who make up the construction gangs on the two night shifts at the Radford Ordnance Works in Virginia. The skid units carry Kohler gasoline-electric generating sets, typically of 6,000-w. capacity to feed four 1,000-w. floodlamps and a string of ordinary

200-w. bulbs, and in cold weather are equipped with stove-heated houses for the light plant operators. Tractors or trucks move the skid rigs from one location to the next. Most of the units have adjustable masts for regulating the elevation of the floodlamps.

Practically all job operations except paving of roads and parking areas, on which construction pressure is less intense, continue through the night, or-

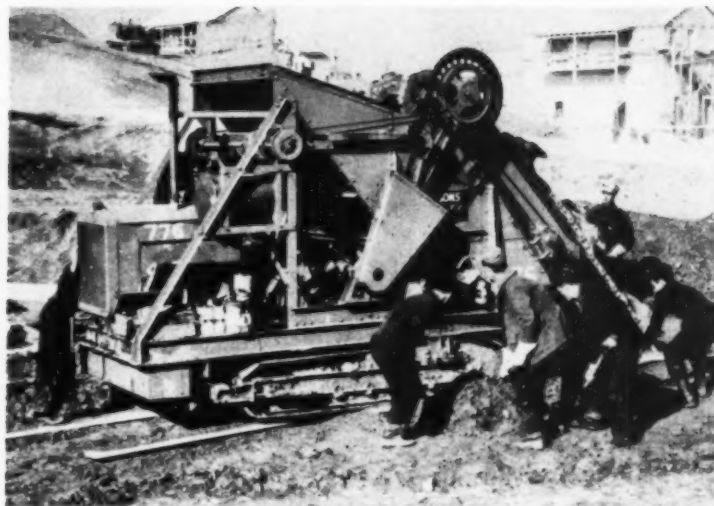
dinarily on a reduced scale. Concreting is an exception; the concrete plant and truck-mixer fleet maintain close-to-capacity production on all three shifts. Other work such as timber, brick and tile construction, excavation, installation of utilities, and erection of powerhouse structure and equipment is carried on without stoppage at night in all cases where 24-hr. effort helps to speed completion of the powder plant.



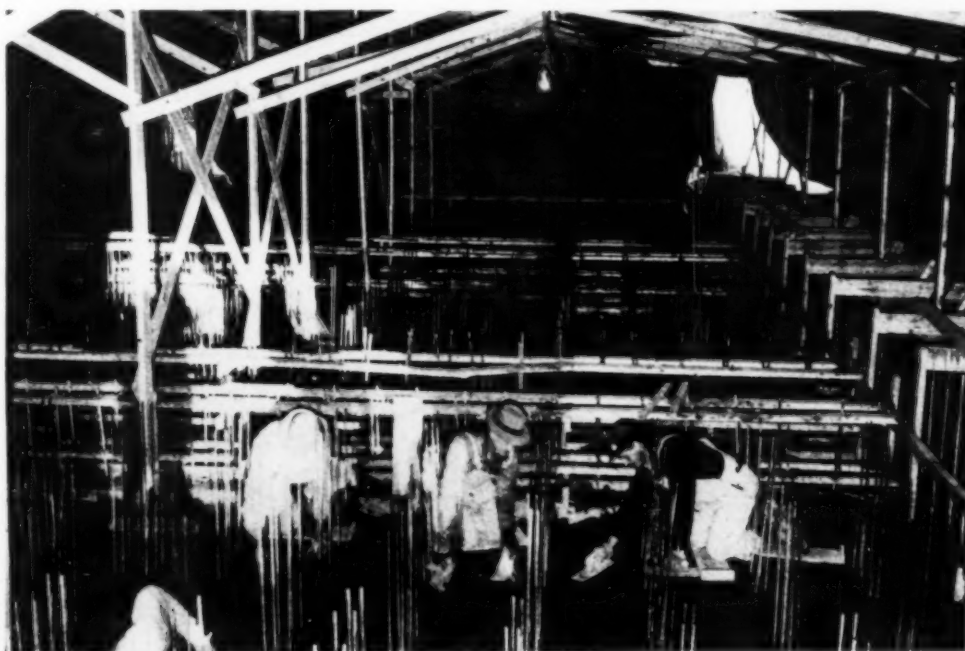
BRILLIANTLY LIGHTED by hundreds of fixed and portable floodlights, plus thousands of ordinary electric lamps, \$41,000,000 powder plant project goes ahead without interruption during hours of darkness as 5,000 workmen on two night shifts carry on work of larger day shift.



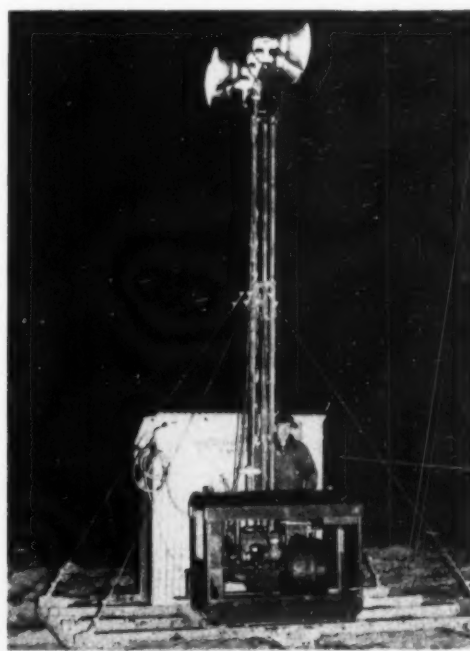
PIPE JOINTS are made with Dresser couplings. Workmen at right holds hose-sheathed sling used for handling pipe into trench.



TYPICAL OF DITCHING OPERATIONS for underground utilities, this trenching machine excavates to grade for sewer.



CEMENT FINISHERS float concrete slab floor inside canvas housing.



THROWING LIGHT two ways on separate building jobs, 6,000-w. light plant supplies power to four 1,000-w. floodlights on crossarm and to series of ten 200-w. lamps strung between buildings. Operator stands in front of stove-heated house at foot of mast, which has been extended to maximum elevation.



COMPLETELY EQUIPPED except for operator's house, which is not needed on all units, this portable skid-mounted light plant has capacity to operate four floodlamps, on crossarm of adjustable mast, and string of lower-wattage lamps, in addition. Note hand-cranked windlass for hoisting telescopic mast and ladder to higher elevation

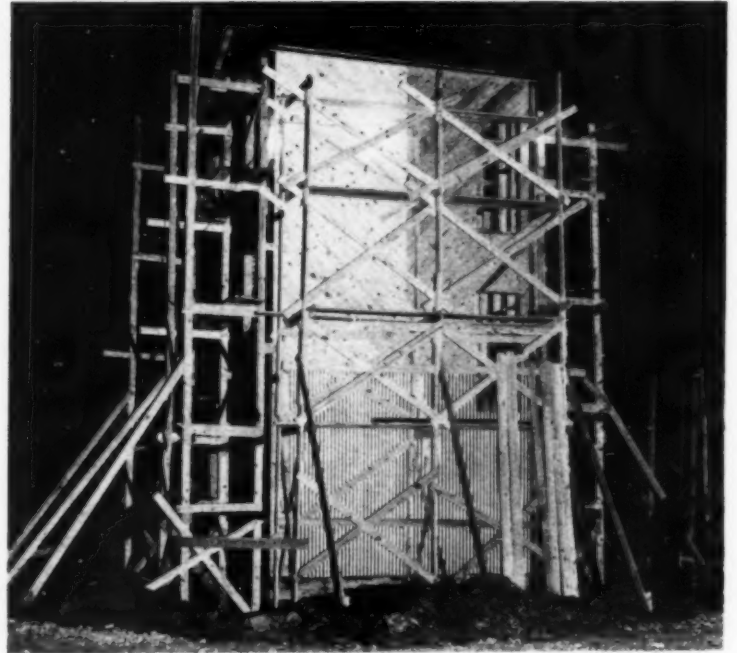


PORTABLE BELT CONVEYOR unloads stone cars at night in light of car-bide floodlamp.

Radford Ordnance Works... Continued



CONCRETE for small, inaccessible pour in water treatment building at filter plant is handled in buckets at night.



LIGHTED by portable plants, erection of can pack building continues through night. Diagonal wood sheathing is covered with corrugated asbestos-cement exterior facing.



SLAKING TIMBERS at night, tractor is able to work without headlamps on brightly lighted job.



ILLUMINATION (right) by portable light plants enables workmen to erect without difficulty 8x8-in. by 27 and 28-ft. timbers, handled by truck crane, for barricade around solvent recovery building, which is reinforced-concrete structure inclosed with corrugated asbestos-cement sheets on wood frame. Barricade will be sheathed with lumber and filled with earth.



FIXED LIGHTS illuminate central mixing plant, where truck drum is being charged from hopper fed by two 1-yd. mixers.



FORMWORK progresses under floodlamps as carpenters get ready for foundation wall pour.

JOB oddities



NEW PICKETING TECHNIQUE is adopted at Gallup, N. M., where mounted cowboys patrol \$9,000,000 construction project at Fort Wingate Ordnance Depot in interests of closed shop for A. F. of L. workers.

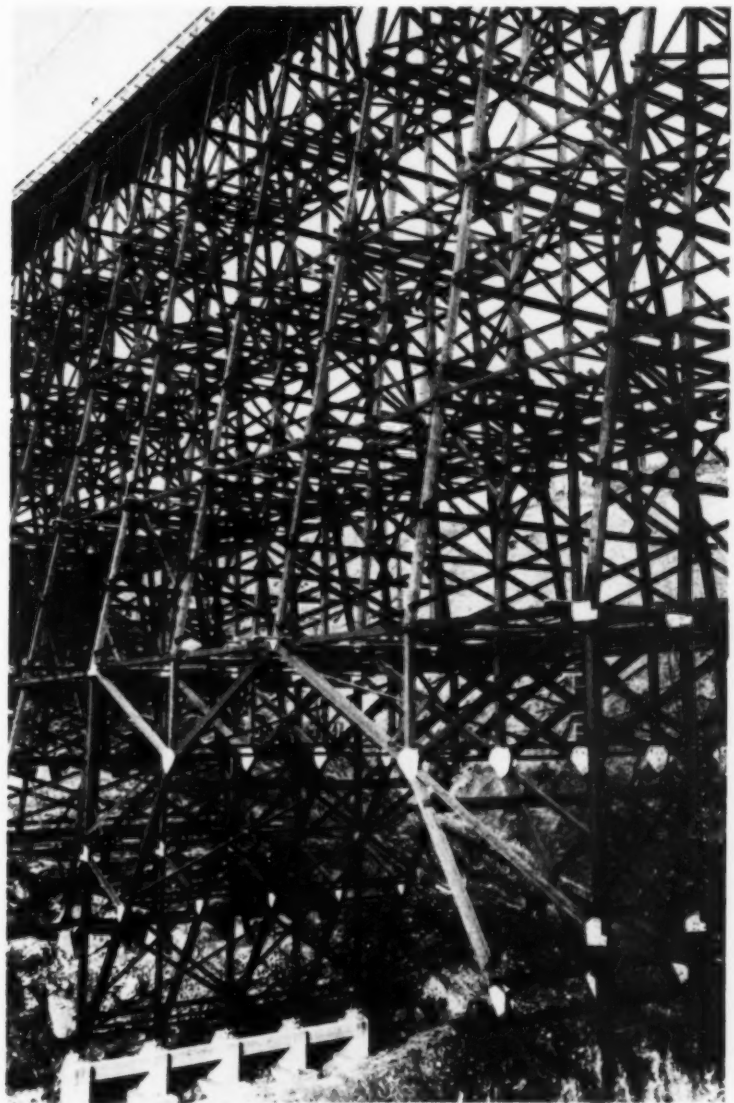
Wide World Photo



THESE WAVY LINES on traffic stripe of Nevada state highway are not result of over-indulgence in "cup that cheers" by traffic line marker. They are made by Nevada's Department of Highways with purpose of warning motorists of approach to railway grade crossing, visible in background.



PRIZE WINNING FLOAT in public utilities class of 1941 Tournament of Roses parade in Pasadena, Calif., is entry of Metropolitan Water District of Southern California, symbolizing conquest of drought by construction of Colorado River aqueduct supplying water to 13 cities, represented by stars in back-drop behind Eleanor Thomas, Queen of Water District. Float is 32 ft. long and 14 ft. high. From mouth of floral urn at front end of float stream of water, represented by blue delphiniums, gushes forth.



BIG BILL OF LUMBER was required to construct logging railroad bridge of Douglas fir, 200 ft. high above footings and 1,130 ft. long, for Weyerhaeuser Timber Co. across Baird Creek near Longview, Wash. About 408,000 ft. b.m. of creosoted timber was used in arch members and framed bents, in addition to 272 pieces of piling from 30 to 120 ft. long. All-wood structure was erected by Hart Construction Co., of Tacoma, Wash.



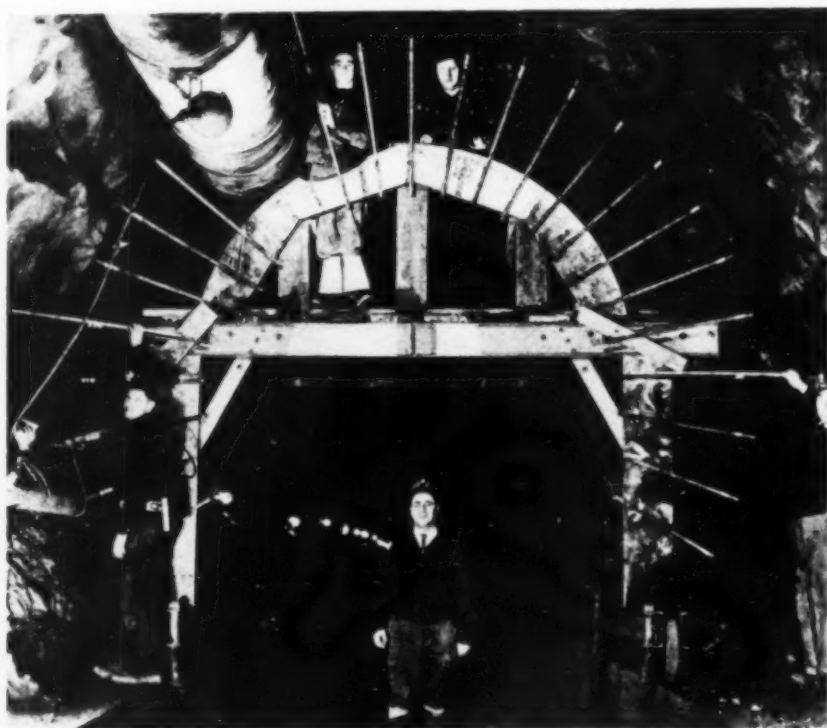
PONTOON-MOUNTED CONVEYOR BELTS carry to worked-out pond, for disposal, overburden from sand and gravel deposit near plant of Shelby Penal Farm, Memphis, Tenn. Installation of Link-Belt equipment consists of 30-in.-wide land-mounted conveyor fed by hopper filled by $1\frac{1}{2}$ -cu.yd. dragline, and three 100 ft. long 30-in. conveyors mounted on steel pontoons which are positioned by wire rope cables.

HOW

They Did It

CONSTRUCTION DETAILS

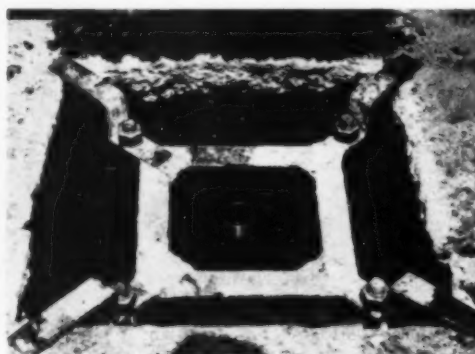
*For
Superintendents and Foremen*



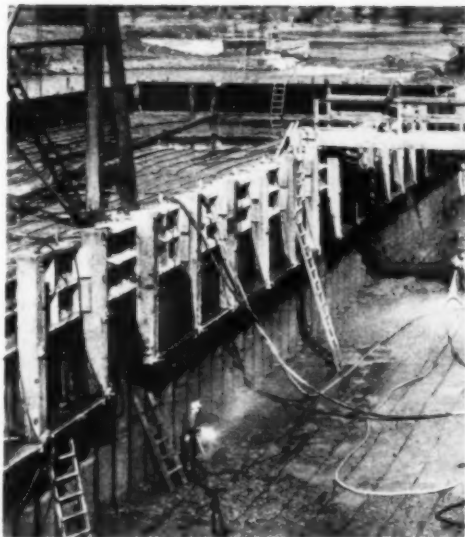
TUNNEL CROSS-SECTIONS on Delaware River aqueduct project of New York City Board of Water Supply are measured, after trimming and prior to placement of concrete lining, with aid of metal bar "feelers" mounted radially on frame supported on platform of contractor's trim carriage. Trim carriage of light steel construction, 9 ft. long, rides along concrete curb walls on four 16-in.-diameter solid rubber wheels. Feelers, in form of 25 metal bars $1\frac{1}{4}$ in. by 36 in. long, are set 10 deg. apart, with their outer ends on 7-ft. radius. An ordinary pocket rule is used to measure distance from face of rock to end of "feeler"; this measurement plus 7 ft. is recorded as radial distance. Cross-sections are measured at 10-ft. intervals along tunnel. With 4- or 5-man field party, average time required to take 25 measurements and move carriage to next station is less than 1 min., according to Louis J. Sack, section engineer for Board of Water Supply on Rondout-West Branch tunnel of Pleasantville Constructors, Inc., where device was used as substitute for time-honored "sunflower" instrument.



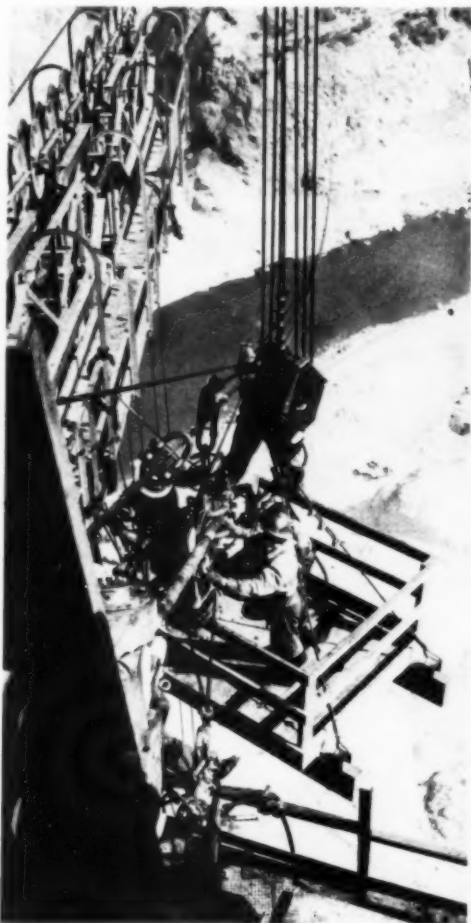
LONG WORK GLOVES protect hands and arms of employees of Southern California Gas Co. while handling hot asphalt. Note stand with vertical column supporting rollers on which pipe is readily turned.



METAL FORM (left) serves as template for positioning anchor bolts and conduit riser for street lighting standards in Memphis, Tenn., prior to pouring of concrete bases by Forcum-Jones Co. Form is of $\frac{3}{16}$ -in. metal with holes drilled to hold anchor bolts by means of nuts on threaded ends. After concrete has set, nuts are unscrewed and template removed. Device proves useful where soil in walls of pit is firm enough to stand and form mold without using outside forms. — Photo from GLEN W. FERGUSON, Memphis, (Tenn.) Light, Gas & Water Division.



CANTILEVER FORM PANELS that eliminate need for inside fastenings and simplify operation of pouring concrete have been designed by Griffith Co. and Bent Co., contractors, for use at Friant dam, U. S. Bureau of Reclamation project in California. Each form panel is 50 ft. long and 10 ft. high, allowing 5-ft. projection for each successive lift of concrete. Of extra heavy construction, principal members include 10x14-in. posts (left) set vertically on 9-ft. centers, each containing three 1 1/4-in. bolts, for supporting form from anchorage in previously poured concrete. In each form panel there are three 3x12-in. longitudinal runners, supporting an inner corrugated or plain facing of wood covered with light sheet metal against which concrete is poured. Working platforms are suspended by chains from each form panel.



HANGING SCAFFOLD, suspended from hook of American pillar crane, provides working platform for riggers attaching one of half-mile-long 3-in.-diameter main cableways to 460-ft.-high head tower at Shasta dam, U. S. Bureau of Reclamation project in California.



FOR LAYING ELECTRIC CABLE UNDERGROUND on line between Omaha, Neb., and Sacramento, Calif., construction crews of American Telephone & Telegraph Co. employ these mobile rigs in vicinity of Millard, Neb. Equipment hauled by tractor includes rooter which cuts narrow trench, 3 in. wide and about 30 in. deep. It is followed by machine with deep-running tooth which clears away earth and lays cable in trench bottom. Cable-laying rig is served by crawler-mounted carriage on which large cable reels are mounted.

Wide World Photo



GRAVEL AND BINDER SOIL for stabilized mix used to rebuild 12-mi. section of historic Natchez Trace route near Natchez, Miss., is prepared by dumping material into drum of standard Foote 27E concrete paving mixer. Mixed material is discharged through constantly open chute from drum in continuous stream to 10-ft. Buckeye spreader box. Applied in two compacted layers of 3 in. each, surface of stabilized soil-aggregate mix is treated with 1 1/2 lb. per square yard of flake calcium chloride, renewed periodically, to insure moisture bond.

WANTED — Photos of Details

The Editor of Construction Methods wants photographs or sketches illustrating interesting DETAILS of method or equipment and will pay for those he finds acceptable for publication.

Hasn't your job produced some DETAIL that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.



ABSENCE OF FALSEWORK and rubbish around buildings is striking feature of contractors' methods. Large amount of prefabrication minimizes waste and what little there is, is kept cleaned up.



R. M. CONNOR (right) and **PAUL B. TICHENOR** are project manager and general superintendent, respectively, for Ford J. Twaits Co. and Morrison-Knudsen Co., Inc., on \$9,000,000 Fort Ord cantonment lump-sum contract.

New Building Every 54 Minutes

**Marks Army Camp Construction
Pace at Fort Ord, California**



TYPICAL ROW of 63-man barracks shows construction stages, progressing from completed rafters against skyline to incomplete first story in foreground.

By N. A. BOWERS
Pacific Coast Editor
Construction Methods

OF THE 1,200 WOOD-FRAME STRUCTURES now nearing completion at Fort Ord, Calif., near Monterey, 820 were built in a 3½-month period. The rough carpentry was finished and the buildings were roofed over at the rate of one every 54 min. during the working hours of a one-shift, 6-day week. This progress rate, in which the Fort Ord contractors are believed to have set a record, is based on total working time after construction started and makes no allowance for rainy days. The speedy construction was appreciated by the Army—witness the fact that on all three of the contracts, some of the barracks were occupied by troops ahead of schedule.

A lump-sum contract covers the work at Fort Ord and is given much of the credit for the speed attained. Organization for "line production" methods, a high degree of standardization, and the use of an "expediter" in each division are among the factors contributing to speed outlined in the following.

Ford J. Twaits and Morrison-Knudsen Co., Inc., received three general contracts for Fort Ord construction beginning with a \$2,730,000 contract for 540 buildings awarded Aug. 28, 1940, and scheduled for completion in 90 days. The total of the three contracts is about \$9,000,000 and the last of the work was to have been finished April 3, 1941.

Camp Ord, typical of the "wide open spaces" of the West, is a big place. It spreads over some 19,000 acres. Buildings are concentrated at east and main



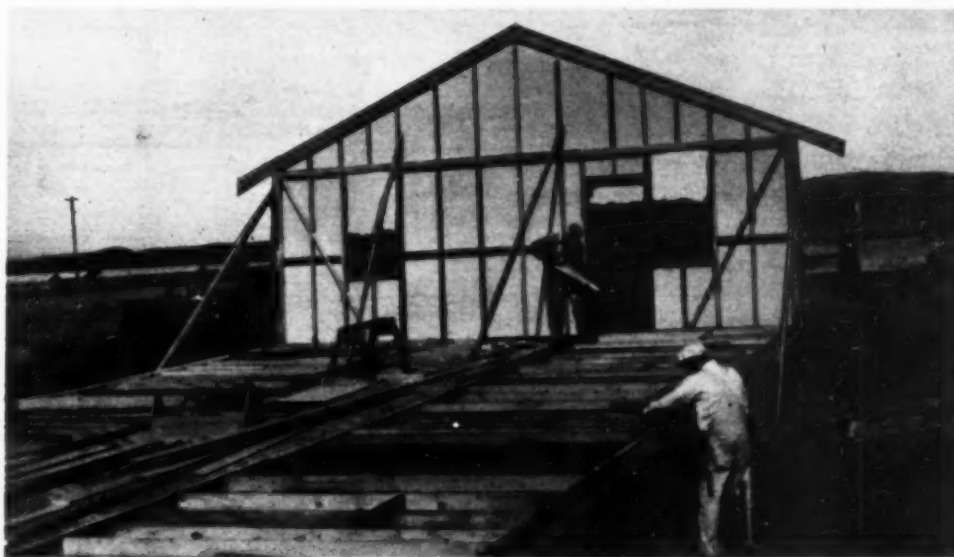
WOOD-WORKING MILL is row of eleven DeWalt saws in open air, with ample room for storing pre fabricated parts. Saw and its bench are located at base of each power pole.



FLOOR BEAMS AND JOISTS are put up by crew that handles dimension lumber only.



PRE-FABRICATED PANELS are stacked at mill. Precut and pre-fabricated items contribute much to speed in assembly.



BUILDING ENDS go up first and are braced externally. Sidewalls then are laid out on flat prior to being raised into vertical position.



WALL OPENING CUTS are being finished by carpenters as laborers help in raising.



LIFT OF SIDEWALL is started by crew spaced along length of unit. Note upright pieces nailed to outside wall as stops.

COMPLETION OF LIFT (below) is easy after first heavy heave is made.



garrisons; the latter, roughly 7,000 ft. square, contains most of the buildings described in the following. This location is close to the ocean shore on Monterey Bay about 6 mi. from the city of Monterey and 14 mi. from Salinas.

Job Of Sawing Wood

The expression that best typifies both the policy and the requirements of this job is "sawing wood." Some 2,000,000 cu.yd. of grading was done and about 25,000 cu.yd. of concrete is required, but when it came to lumber the orders totaled 35,000,000 ft.b.m. The lumber all comes to the job surfaced on four sides so that no planing has to be done; sawing, on the other hand, is a constant and major requirement.

The busiest pieces of equipment on the job are the eleven 16-in. DeWalt saws mounted on benches in the mill area, and the 140 portable Skilsaws. The former do the heavy work and the latter are in demand all over the job. There is relatively little use of hand saws.

Lumber comes mostly by rail to the Fort Ord sidings and is unloaded beside the mill area which California climate makes it unnecessary to roof. Two of the eleven bench-mounted saws are equipped with dado heads for special cutting such as grooving, notching rafters, etc. A very large part of the lumber

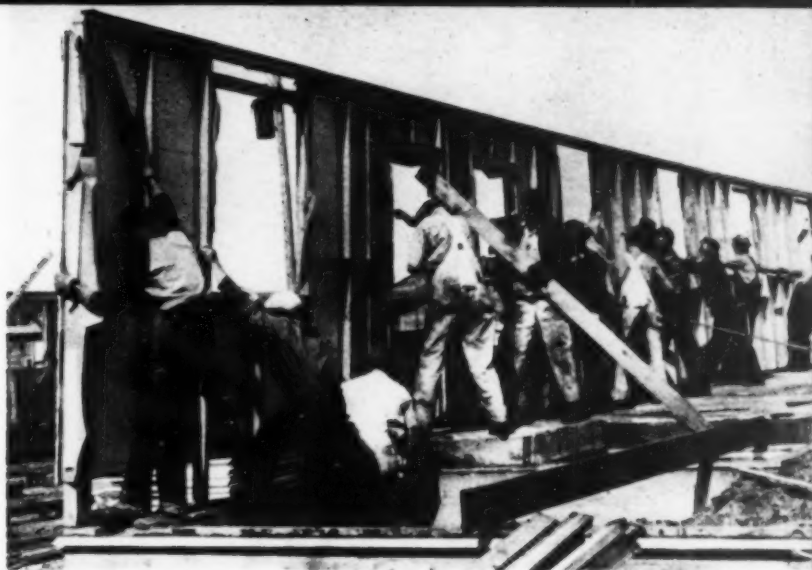


MAIN GARRISON AT FORT ORD mobilization camp in California is close to shores of Monterey Bay. Barracks and other construction involved three general contracts aggregating \$9,000,000.

HOUSING FOR 25,000 OFFICERS AND MEN is provided. Water supply is stored in two banks of four 120,000-gal. wood-stave tanks.



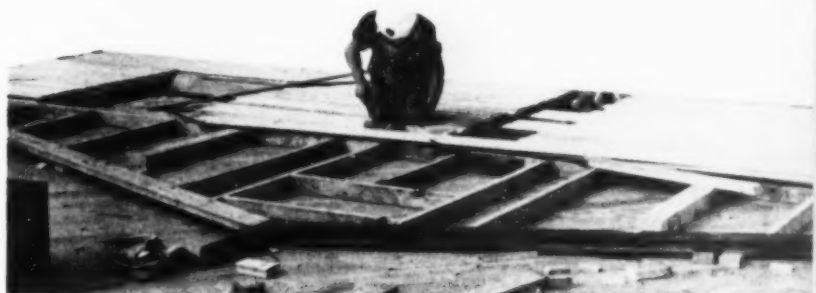
TRIMMING OF SHEATHING (below) around openings is done with electrically powered Skilsaw before walls are raised.



WALL IS HELD UPRIGHT while temporary braces are nailed on and then entire crew turns to other sidewall.



WHEN BOTH WALLS ARE BRACED, extra men (laborers) return to their jobs and carpenters remain to carry on.



SECOND-STORY GABLE END is fabricated in horizontal position. Covering on all outside walls includes gypsum boards, building paper and 1-in. tongue-and-groove sheathing.

ON SUB-FLOOR of second story (below), workmen prepare sidewall panels for next wall raising.





Help your

... Get Them While They're Hot! Don't Let Old Equipment Hold You Back ... Modernize Now With A-C Cost-Cutting Pacemakers!

The Construction job ahead almost staggers the senses. Too big to visualize—we only know there's plenty of work to be done ... and to be done now. Already ... first eight weeks of 1941 public construction awards top corresponding 1940 period by 123%.* If you aren't getting your share, check up on your equipment. Now is no time to drift! Let your Allis-Chalmers dealer streamline your outfit. He has today's tools ... to handle today's work—a modern, complete line to fill any dirt-moving need. See him ... NOW.

* Engineering News-Record Weekly Report—2-20-41

Move dirt the cheap way—with modern, powerful, smoother-running 2-cycle Diesel tractors pulling and pushing big capacity Gar Wood Scrapers.



yourself to a BIG YEAR!



Handle more heavy grading and construction hourly, at less cost, with the more flexible Leaning Frame Grader (left) and with the extra-earth moving capacity of the NEW Model A-D Motor Grader (right).



Finish up mean jobs in a hurry and at a profit with this Model WM tractor and Hough Shovel. You'll find dozens of uses for this outfit!



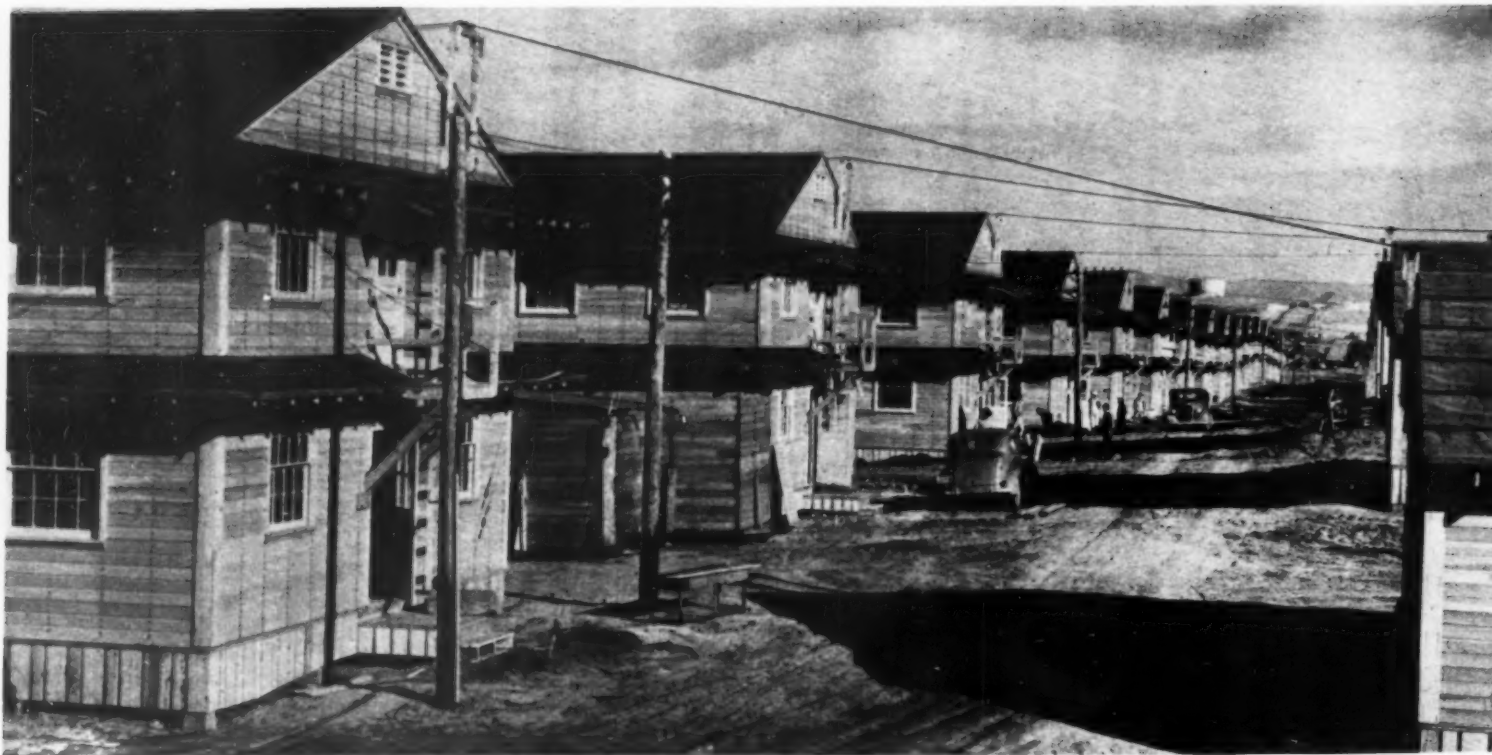
Smooth out hauling roads ... keep finished work in shape with this low cost W-Speed Patrol. Ideal for light grading and maintenance!

ALLIS-CHALMERS POWER

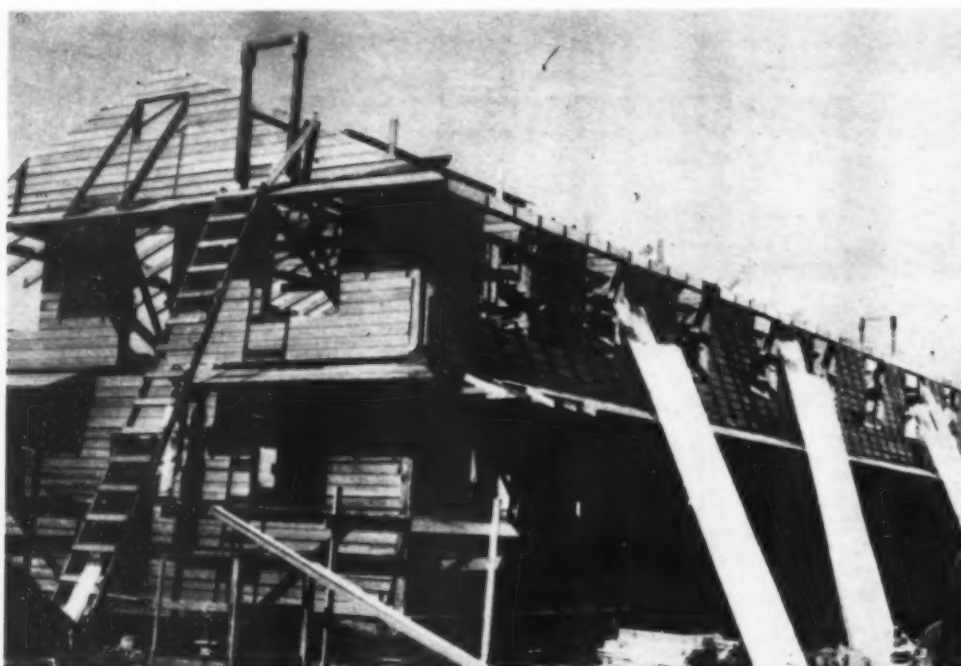
TRACTOR DIVISION - MILWAUKEE, U.S.A.

TRACTORS, ENGINES, ROAD MACHINERY

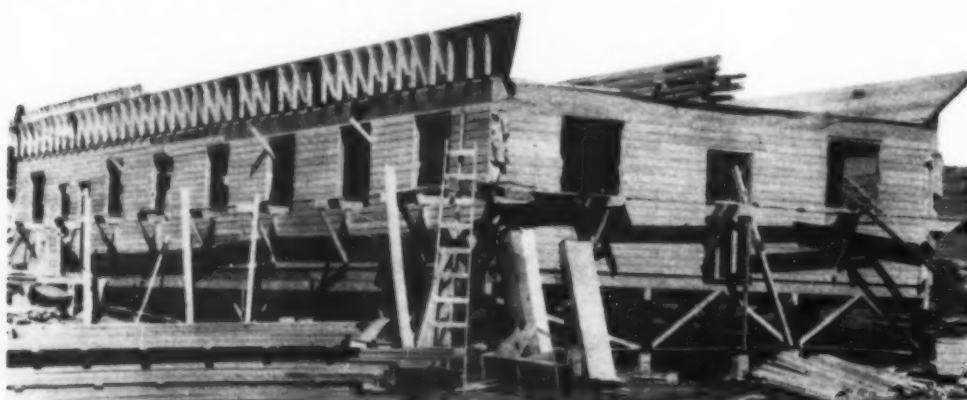
IT DOESN'T COST ... *it Pays!*



COMPLETED ROW of 2-story wood barracks is ready for occupancy by troops.



TYPICAL 63-MAN BARRACK is here shown with construction well advanced. Rafters are up and roof sheathing is stacked ready to be handed up. Rectangular frame projecting above gable is for electric wires, shown in photograph at top of page.



BRACKETS supporting "eye-brow" roof go up as part of sidewalls. Staging here shown at lower-floor window-level is only falsework required on entire building.

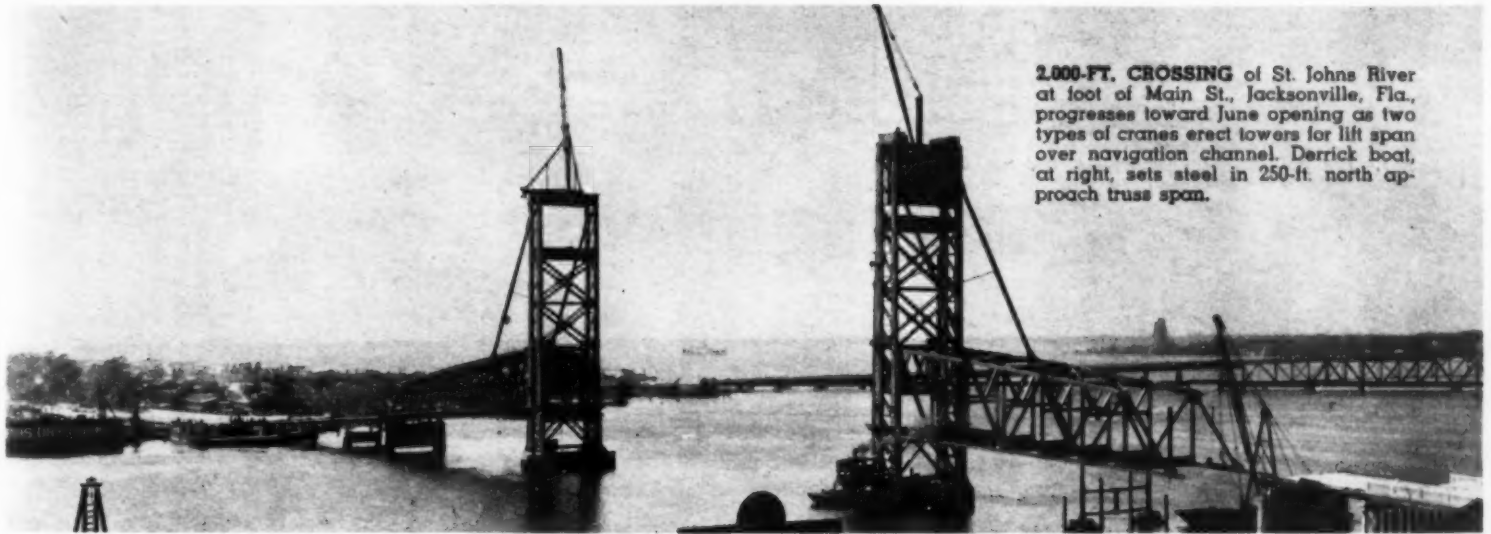
that goes into each building is pre-cut and some is pre-assembled before it gets to the building. Porch units, stairs, fire escapes, ladders, secondary electrical brackets, shelves, mess hall tables, mail boxes, theatre seats, etc. are made up and stacked in the mill area ready for delivery as required. All this pre-assembly speeds the work and decreases confusion and litter around the buildings.

Some special lumber was bought from planing mills. For example, all window frame materials, milled ready for assembly, are delivered to the job in shooks. Window frames are put together on jigs by crews consisting of two carpenters and a laborer. The latter unpacks the shooks and piles the parts as they are needed on a wide bench built to convenient height just behind the carpenters. A carpenter's vise at one end of the jig affords means of quickly putting the assembled frame under pressure to hold it together while the nailing is done. Such a crew of three men turns out 185 to 200 window frames per 8-hr. shift. These and other similar jigs are out in the open adjoining the mill area. Whenever increased demand makes it necessary, additional crews are added to step up the output.

Indicative of the large scale of operation are these three items in the bill of materials: 3,000,000 sq. ft. of tongue-and-groove gypsum sheathing, about 4,000,000 sq. ft. of Sheetrock (for interior wall partitions), and some 6,000,000 sq. ft. of double-kraft waterproof building paper.

Most important factor in speed is the contractor's organization which is planned to operate on what might be termed a continuous "assembly-line"

(Continued on page 120)

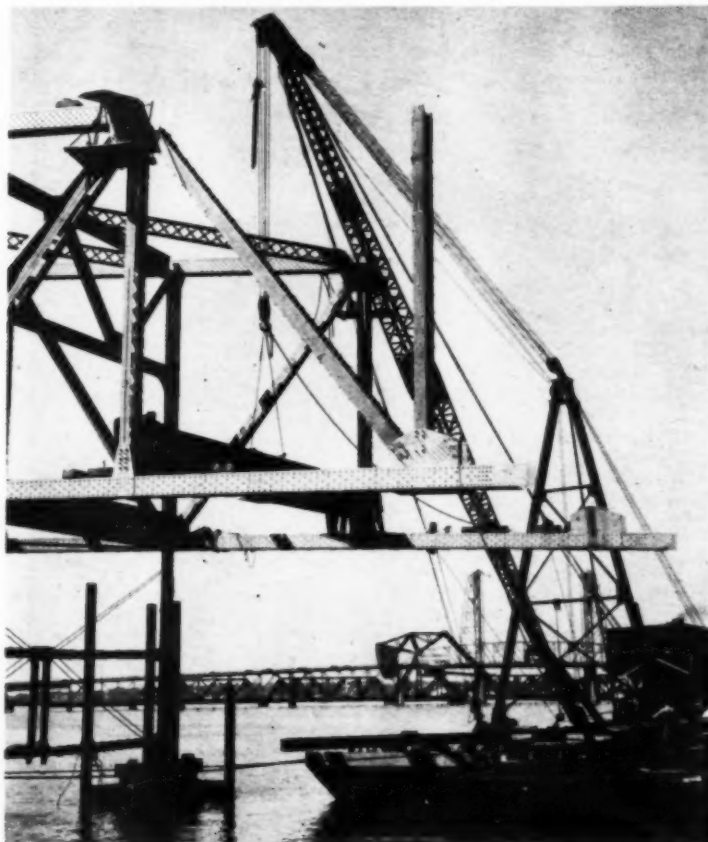


2,000-FT. CROSSING of St. Johns River at foot of Main St., Jacksonville, Fla., progresses toward June opening as two types of cranes erect towers for lift span over navigation channel. Derrick boat, at right, sets steel in 250-ft. north approach truss span.

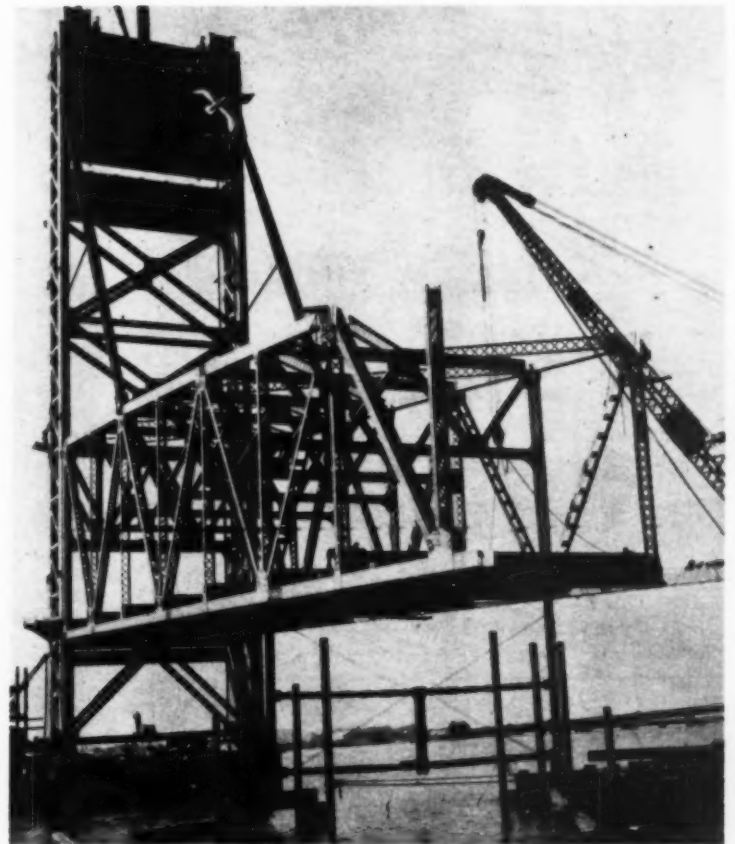
A SECOND LIFT BRIDGE across the St. Johns River, Jacksonville, Fla., probably will be open to traffic by June 1, according to State Highway Engineer J. H. Dowling, relieving congestion on the existing structure. Mt. Vernon Bridge Co., Mt. Vernon, Ohio, H. W. Smith, superintendent, is fabricating and erecting 3,000 tons of steel in lift span, two truss spans, and three continuous girder spans resting on total of seven piers constructed by Foundation Co., New York. Two towers are on caisson piers sunk to maximum depth of about 95 ft. in water up to 70 ft. deep. Steel erector uses stiff-leg derrick on one tower and pillar crane in counterweight box on other. Lift span providing hori-

*Stiff-Leg and
Pillar Cranes*
**Erect Towers for
Jacksonville
Lift Bridge**

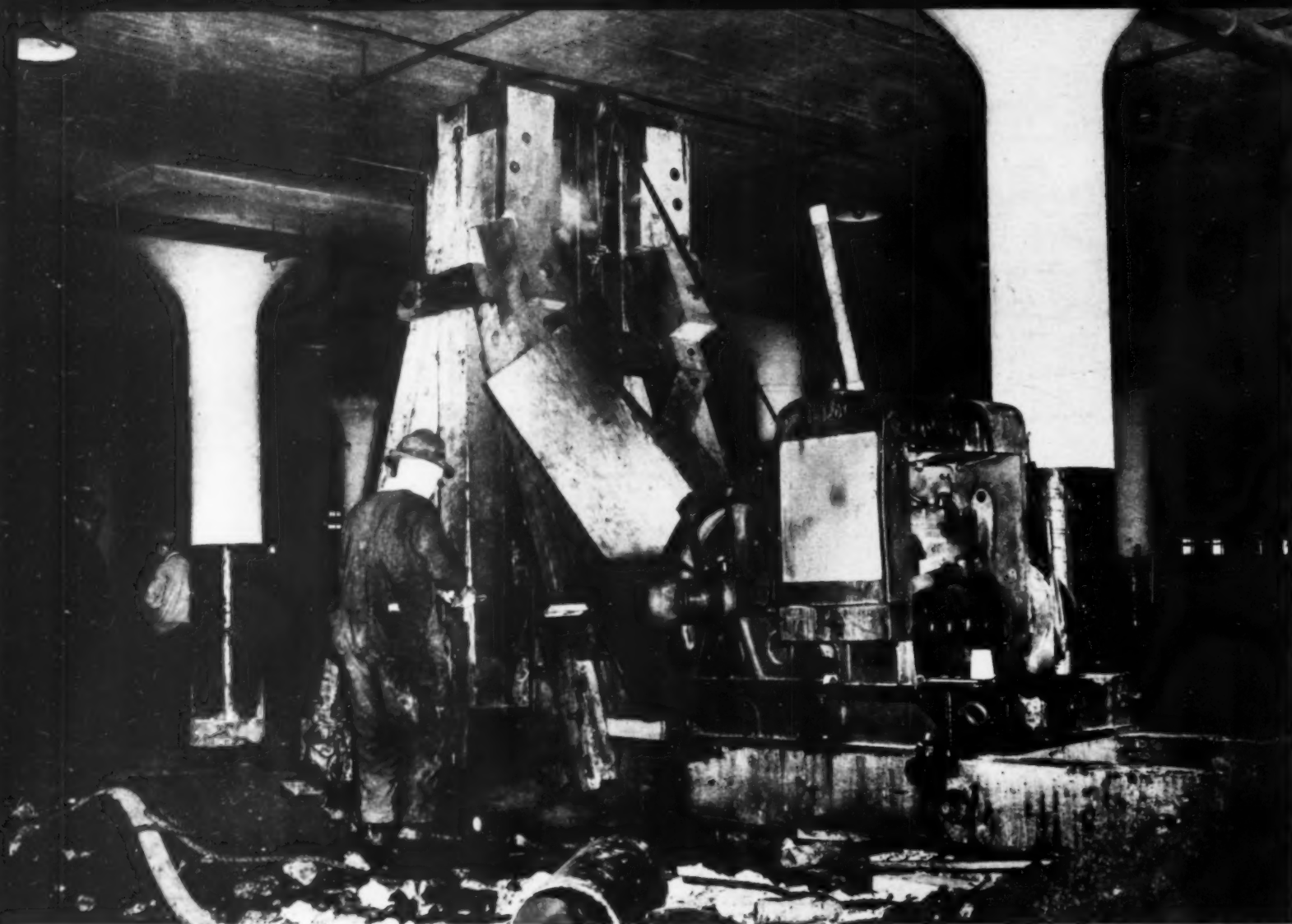
zontal clearance of 365 ft. and minimum vertical clearance of 135 ft. will be erected in raised position. Shell Producers Co., Tampa, Fla., built I-beam-and-concrete-deck approach spans on concrete-incased H-pile bents. H. E. Wolfe Construction Co., St. Augustine, Fla., is grading and paving land approaches. Length of bridge, 2,060 ft.; roadway width, 42 ft.; two sidewalks, each 7 ft. wide. Ash, Howard, Needles & Tammen, New York and Kansas City, acted as consulting engineers on design. M. V. Moore is project engineer in charge of steel erection and completion of bridge for Florida State Road Department. W. E. Dean was project engineer on substructure work.



FLOOR BEAM of north approach truss span is lowered to position by derrick boat. In background, beyond railroad bascule bridge, are towers of existing highway lift bridge, only present connection from city to South Jacksonville, St. Augustine and adjacent East Coast of Florida.



STEEL H-PILE FALSEWORK BENT supports truss span during erection by floating equipment. Pillar crane on tower is set in counterweight box, here raised to fifth erection position.

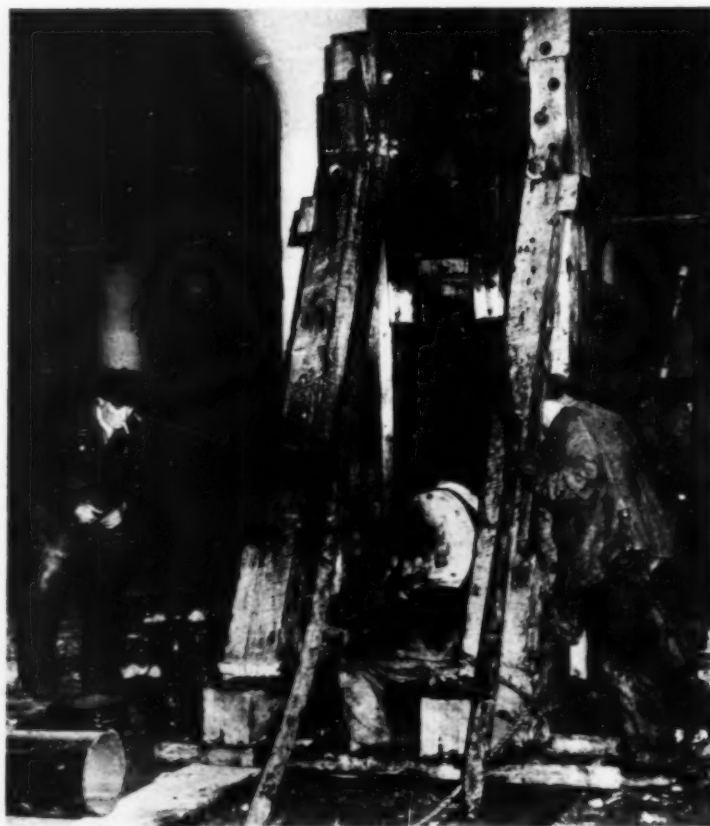
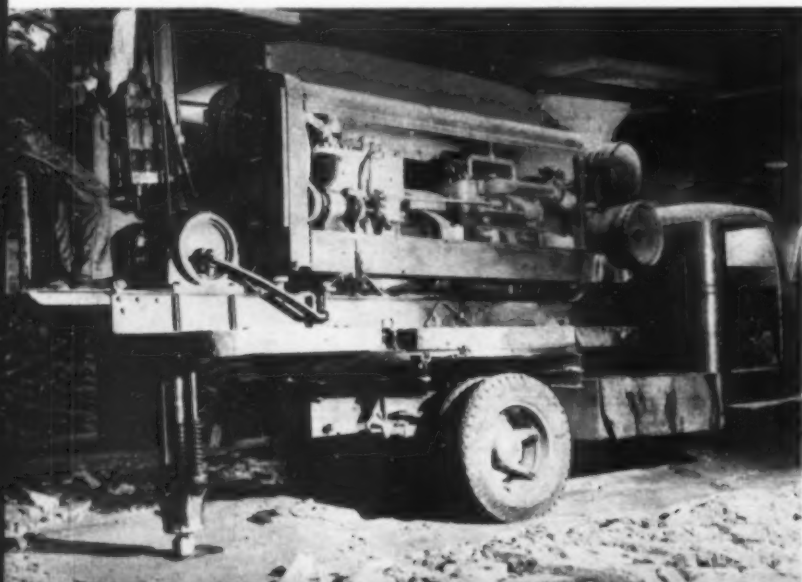


LIMITED VERTICAL CLEARANCE between floor and ceiling, (the latter carrying sprinkler piping) required piledriving rigs with leads only 9 ft. 3 in. high. Movement of 5,000-lb. steam hammer is controlled by single-drum gasoline hoist.

"Dwarf" Piledrivers

**Operate With Low Headroom
Inside Building**

BREAKING UP OF OLD CONCRETE FLOOR (below) is done with special truck-mounted rig. Impact tool, delivering 60 blows per minute, is powered by air compressor.



STEAM-OPERATED PILE HAMMER weighing 5,000 lb., equipped with driving head, is hung in leads of low-clearance A-frame rig of heavy timber design. On ground at left, note length of 10 $\frac{3}{4}$ -in. o.d. steel pile casing and, behind it, two of special cast-steel flanged sleeves for making joints between 5-6-ft. pipe lengths.

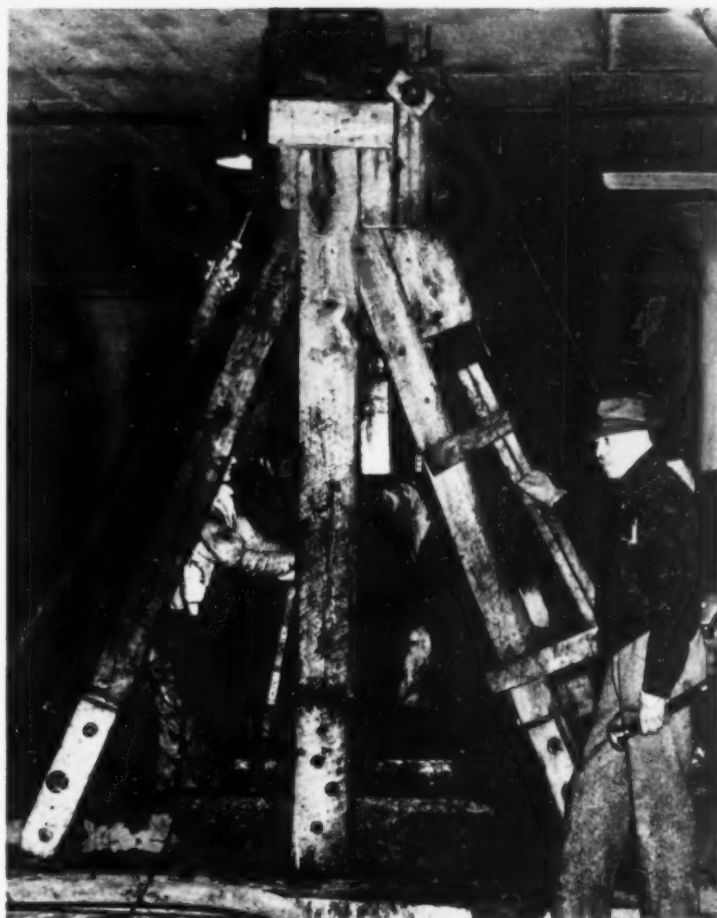


SUPERINTENDENT for general contractor, Laurance C. Roberts, Inc., is J. K. Bell (left) who is assisted by A. OLSEN.



LOW WORKING HEADROOM of only 9½ ft. within an existing building made it necessary to design "dwarf" piledrivers on project of replacing concrete floor to carry heavy loads of machine tool installation.

HEAVY TIMBER A-FRAME (right) with bolted connections is made up of 10x10-in. sills and 8x8-in. verticals and inclined braces.



LIMITED BY A WORKING HEADROOM of only 9½ ft. within an existing industrial building, Laurance C. Roberts, Inc., general contractor, was called upon to drive more than 700 concrete-filled steel piles to depths of from 25 to 32 ft. to support a concrete ground floor of a motor-truck service structure in Long Island City, N. Y. The building had been acquired from the White Motor Company by The Ford Instrument Co. for the manufacture of certain equipment for national defense needs. The problem was solved by using a fleet of five "dwarf" piledrivers, designed especially to operate within the 9½-ft. vertical clearance between the floor and lowest pipe conditions of the building, and a boiler installation of capacity to operate five rigs.

The building, a reinforced concrete frame structure 440x200 ft. in plan, with mushroom type cylindrical columns, is located on filled ground. An examination of the property disclosed the fact that in many places the earth had settled from 2 to 15 in., leaving the concrete floor without foundation support (except where it joined the pile-supported columns) over considerable areas. Test pits and borings also disclosed the presence of ground water only 3 ft. below the earth surface at the site and inadequate soil bearing for 15-ft. depth. As the manufacturing operations of the Ford Instrument Co. required the installation of many heavy machine tools it was decided to remove the existing 8-in. thick concrete floor, drive piles spaced about 10 ft. on centers in both directions over the entire building area and pour a new floor 8 in. thick which could be depended upon to carry, without settlement, the concentrated loads of the proposed machine tool installation in accordance with the Ford Instrument Co.'s requirements.

Breaking Old Floor—In adapting the building, (formerly used for servicing trucks and buses and handling spare

(Continued on page 118)



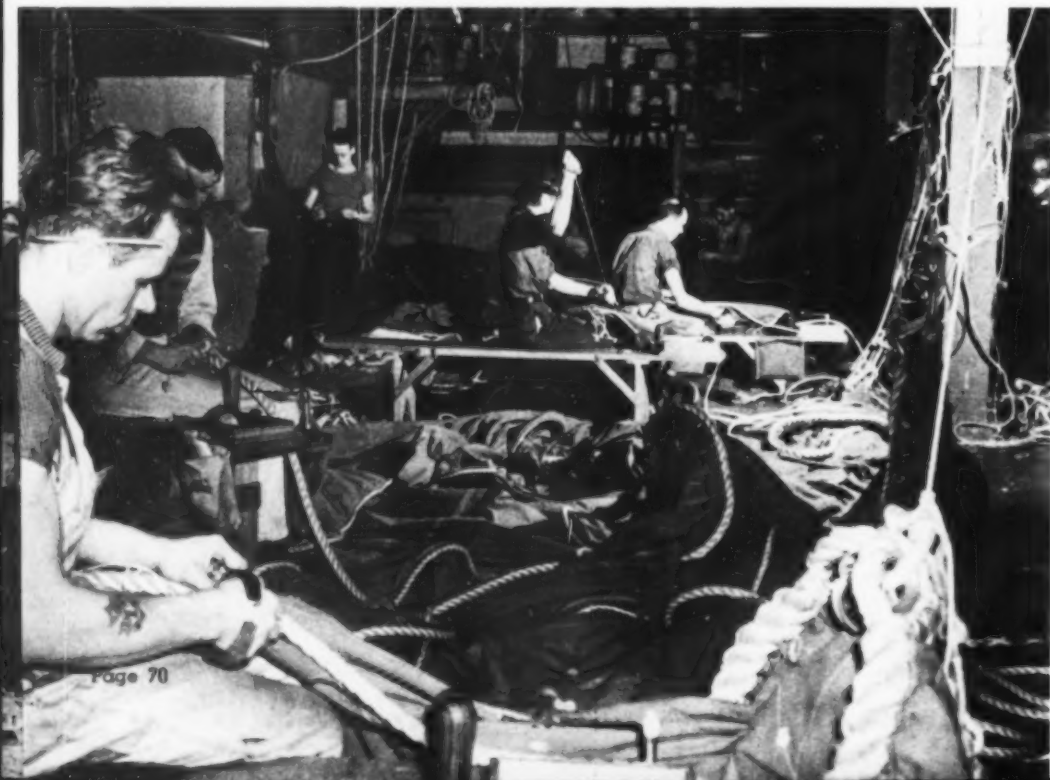
FINAL OPERATION consists of filling pile casings with concrete shoveled into funnel from 2-wheel buggy



CANVAS COVER of 13,000 sq.ft. area is slung in gorge by cable system to protect from rain earth fill for core of dam.

International News
Reel Photo

IN TENT MAKER'S SHOP (below) in Seattle huge cover is made up of 28½-in.-wide strips of 10-oz waterproof duck, shaped to fit irregularities of canyon walls between which it will be hung.



Page 70

Huge *Canvas Tent* **PROTECTS** **EARTH FILL AT** **MUD MOUNTAIN** **DAM**

A CANVAS COVER weighing approximately 35,000 lb. and costing about \$35,000, product of day and night rush work by the Seattle Tent & Awning Co. under the supervision of T. H. MacGeorge, manager, has been hung in the deep, narrow gorge near Seattle, Wash., where Mud Mountain dam is under construction in order to protect from rain the rolled earth-fill core now being placed by the Guy F. Atkinson Co., contractor. The tent is slung from a cable system suspended from ringbolts fastened to the precipitous rock walls of White River Canyon at the damsite. In addition to providing mere static support for the tent itself, the "spider web" of wire rope is so designed that by means of a pulley system, it will be possible to tilt the tent surfaces enough to dump a

(Continued on page 119)



ASSEMBLY OF TENT required use of 29,000 ft. of manila rope ranging in diameter from ½ to 2½ in., 7,000 rope splices and 1,000 reef points.



CONSTRUCTING QUARTERMASTER for U. S. Army at Camp Blanding, about 50 mi. from Jacksonville, Fla., is **MAJOR JAMES R. RUNDELL** who is supervising construction for cantonment to house 75,000 men.

Harris & Ewing Photo

Present and Accounted For

A PAGE OF PERSONALITIES



FIRST PRESIDENT of Ground Hog Club, newly organized group of construction men in Chicago area, is **GEORGE S. SALTER**, subway structural designer in Chicago's Department of Subways and Superhighways.



CONSULTANT ON \$4,000,000 BANKHEAD TUNNEL at Mobile, Ala., subaqueous vehicular route opened to traffic last month, is **WAYNE F. PALMER**, member of firm of Wilberding & Palmer, Inc., of Mobile. Mr. Palmer is here shown passing through 4-ft. opening burned through last bulkhead of big tube.



NEW OFFICERS OF CENTRAL BRANCH of Associated General Contractors of America, covering State of Iowa, are: (Seated, left to right) **AMOS MELBERG**, of Cedar Rapids, vice-president; **R. W. MILLER**, of Waterloo, president; **V. L. LUNDEEN**, of Montezuma, vice-president. (Standing) **O. W. CROWLEY**, of Des Moines, secretary; **PAUL B. REIS**, of Des Moines, treasurer.



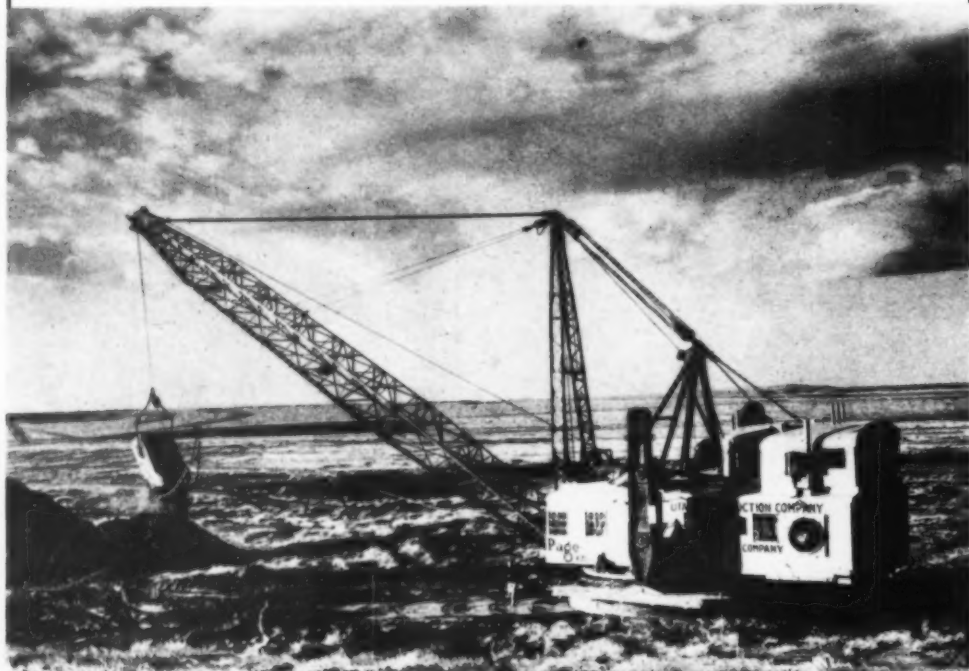
NEW PRESIDENT of Association of Highway Officials of North Atlantic States is **THOMAS G. FRAME**, chief engineer, Pennsylvania Department of Highways, who succeeds H. E. Sargent, commissioner of Vermont Highway Department.



ILLINOIS CONTRACTORS ASSOCIATION, affiliated with Associated General Contractors of America, holds 34th annual convention at Springfield, with local and national officers in attendance. Seated, left to right, are new officers of Illinois association, as follows: **J. F. PARKER**, of Springfield, vice-president; **J. E. DIPPOLD**, of Edwardsville, president; **MILO P. FLICKINGER**, of Springfield, secretary. Standing, left to right, are following officers of national association: **M. W. WATSON**, of Topeka, Kan., president of A.G.C.; **H. B. ZACHRY**, of Laredo, Tex., past-president of A.G.C.; **H. E. FOREMAN**, of Washington, D. C., managing-director of A.G.C.

PAGE TWO-ENGINE DIESEL-POWERED WALKING DRAGLINE

One engine for loading and hoisting
Another separate engine for swinging



On canal work near Tucumcari, New Mexico, Utah Construction Company and Griffith Company use this Page Walker, powered by two Page horizontal Diesels, one mounted above the other. A heavy-duty $6\frac{1}{2}$ -cubic-yard Page Bucket is used on a 110-foot boom.

Here is a new development in large draglines—fast hoist and fast swing at the same time! No longer need the operator delay the swing of the machine waiting for the hoisting of the bucket. Rather, with the balanced power of the Page Two-Engine Walker, acceleration of hoisting and swinging is greatly increased.

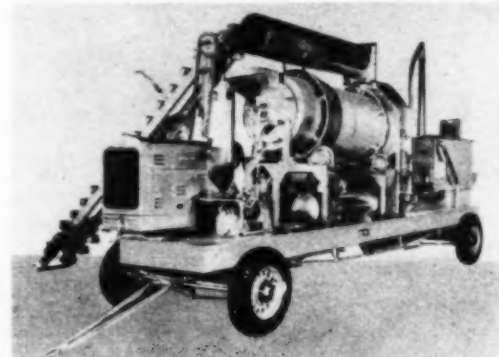
To understand this faster operation with a Page Two-Engine Walker, visualize using all of the power of your present dragline for hoisting only, without swinging the machine. You will find that the hoisting speed will be increased greatly. Now consider a second independent engine for swinging only. This second engine accelerates the swing in proportion to the faster hoist. The two engines—the large Diesel, which only hoists and loads the bucket, and the smaller independent Diesel for swinging as rapidly as the faster hoist demands—furnish perfectly balanced power and increase the number of loaded buckets that can be handled per minute. Learn what a Page Two-Engine Walker will do on your dragline job.

PAGE ENGINEERING COMPANY

Page Automatic Dragline Buckets · Page Walking Dragline Machines
CLEARING POST OFFICE, CHICAGO, ILLINOIS

CONSTRUCTION EQUIPMENT NEWS

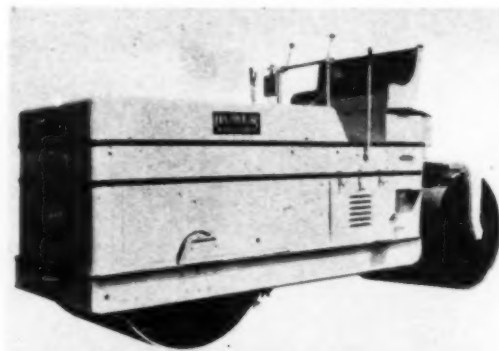
ONE-UNIT PORTABLE ASPHALT REPAIR PLANT with capacity of 8 to 10 tons per hour has two special features: (1) Internally fired rotating dryer; (2) air operation of discharge mechanism. Drying drum is 36 in. in diameter by 8 ft. long, mounted on roller bearing trunnions and chain driven. It has internal, longitudinal side shelves for cascading aggregate and also internal centrally hung cross-flight which increases area on which material dries. Fired by low pressure oil burner with fuel fed by engine-driven pump and air supplied by Worthington 2-cylinder air-cooled compressor. Batch-type



pug mixer, with capacity of 750 lb. per batch, has single axle mounted in roller bearings with individual blades set at 90-deg. quadrant. Asphalt is heated in 220-gal. kettle with two oil burners, fire-proof top and thermometer. Power is furnished by one Continental 6-cylinder 32-hp. engine which drives dryer drum, pug mixer, air compressor fuel pump and cold loading elevator. One man operates three small levers to control air-operated cylinders attached to dryer, mixer and measuring hopper discharge gates. Valve admits hot bitumen to graduated measuring trough which is manually dumped over full length of mixer. Another man supervises operation of machinery and feeding of aggregate into elevator boot. Complete unit mounted on one chassis with semi-elliptic springs and pneumatic tires. Of particular use for repair of city streets and by state and county highway forces for production of paving material. Weight, 15,000 lb.—**White Mfg. Co., Elkhart, Ind.**

★ ★ ★

VARIABLE WEIGHT TANDEM ROLLER incorporates following operating features: (1) Three speeds forward and reverse; (2) dual controls for operating machine from either side; (3) automotive type construction; (4) ease of operation; (5) high frame clearance; (6) easy hydraulic steering; (7) anti-



friction bearings at all strategic points; (8) all moving parts fully accessible; (9) full width seat built to eliminate operator fatigue; (10) large capacity, sturdily built water tank; (11) rust resisting sprinkling pipes. Powered by 6-cylinder, Buda gasoline engine. Diesel power, if desired. Advantages claimed by makers: simplicity of operation, plenty of speed, maximum maneuverability, centralized control of every roller movement, low maintenance and all-around operating economy.—**The Huber Mfg. Co., Marion, Ohio.**



★ LOWER MAINTENANCE COST

Drum shafts, reverse shaft and main power shaft turn on self-aligning roller bearings.

Drum, swing, retract and boom hoist clutches are interchangeable.

Fully enclosed traction gears running in oil in heavy cast steel case.

★ LONGER CABLE LIFE

Drums are of large diameter and grooved to assure perfect winding of cable.

★ GREATER MOBILITY AND TRACTION

Two travel speeds mean suitable traction on steep grades as well as level ground.

Crawlers equipped with recoil springs—prevent track clogging, breakage and loss of traction power.

★ FASTER AND SAFER

New safety-type rapid boom hoist for crane duty. Conventional worm-gear boom hoist optional.

Double, fully enclosed traction brakes, controlled from cab, serve as brake and traction lock.

★ MORE FOR YOUR MONEY

The above are some of the outstanding features that make the LS-60 the greatest money value on the market. It is a husky 31,000 pound shovel that you don't have to "baby"—a dependable crane or clam-shell—a reliable dragline with inhaul speed of 145 ft. per minute and 5 R.P.M. swing. Yes, it's BIG—yet small enough to be moved by trailer over most state highways without special permit. Write for complete details today. Ask for folder 1868.

→SPEEDER→

8915

LINK-BELT SPEEDER CORP.

Builders of the Most Complete Line of Shovels and Cranes

301 W. PERSHING RD., CHICAGO

MODEL T7 TRAXCAVATOR*



DOVE — T7 LOADING BIG GONDOLA CARS IN 12 TO 13 MINUTES

BIG capacity for BIG JOBS

Here is a TRAXCAVATOR capable of handling any job. The model T7 is a big, powerful digging and loading machine, yet is lower in initial cost, lower in operating costs and lower in yardage costs than any other machine of similar size, power and capacity. No machine can match its all-purpose utility, for it combines the usefulness of a SHOVEL, LOADER, SCRAPER, BULLDOZER, ANGLEGRADER, TRAILBUILDER, ETC. Mounted on the "Caterpillar" D7 tractor, this TRAXCAVATOR has plenty of speed, power, stability and traction to handle a 2½ yard bucket and get big production on the toughest jobs. Sold and serviced by "Caterpillar" dealers everywhere. For illustrated catalog write TRACKSON COMPANY, Milwaukee, Wis., U.S.A.

* REG. U. S. PAT. OFF.



B — The full drawbar push of 23,000 lbs. is behind bucket. Enables it to dig the toughest soils, clay, caliche and frost efficiently and at low cost.



DES — Fast, accurate control makes it a "cinch" to grade a close grade with the T7. Note wide, smooth of-way—a one-man job with a TRAXCAVATOR.



LOADS — No machine can match its loading speed economy and the wide range of materials it will efficiently handle. Dumping height sufficient to load big trucks over sides or ends.



CARRIES — The T7 not only digs but can carry its loads at tractor speeds—to the handling units when necessary, or to the fill. Will pile, waste, cast or spread where wanted.

TRAXCAVATORS ARE PROFIT-MAKERS

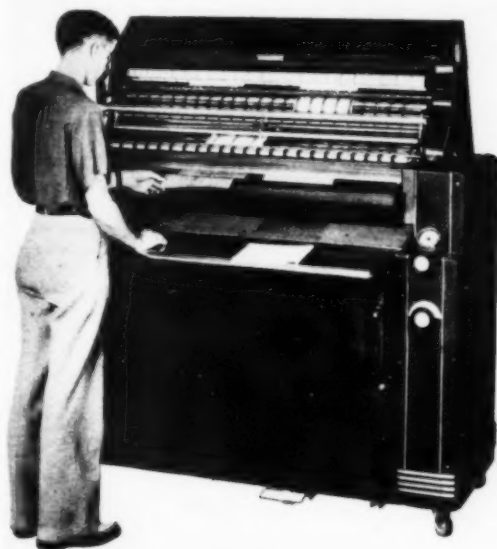
MORTAR AND PLASTER MIXER, 6-cu.ft. capacity, has been entirely redesigned and is said to offer following advantages: (1) Saving of \$10 or more per day over hand mixing method; (2) plaster of higher quality; (3) saving of time. Outstanding features: Criss-cross mixing action with wide arc, structural steel blades pulling sand down into mix; "Handi-Dump" grid on top of drum, permitting



charging while blades are turning; adjustable scrapers; lock which stops drum in mixing or discharging position; "Restrictor-lip" discharge which prevents undue splashing and permits desired spotting of batch; simple, quick-acting and positive control within easy reach of operator; engine cover opens away from shoveling side, protecting engine and gear box from sand, lime dust or plaster; sealed bearings protect blade shaft against misalignment; 4-hp., governor controlled motor; low shoveling height; automotive type cantilever springs protect mixer from jolts and promote sway-free towing; telescopic towing tongue; pneumatic tires and channel iron frame.—Chain Belt Co., Milwaukee, Wis.

★ ★ ★

HIGH SPEED DEVELOPER, designed for use with Bruning Model 75 BW printer, enables one operator to perform entire printing and developing of blueprints with ease and speed, according to manufacturer. In operating developer, sensitized paper and tracings are fed into machine at front where they are immediately exposed in printer section. Vac-



uum separator roll at discharge point of printer separates tracings from exposed prints, allowing them to pass automatically to developing and drying sections of developer. Tracing is returned to operator while print is delivered flat and dry at rear of machine. Developer consists of separator roll, water roll, and series of bands which carry developed prints through drying section. Developing section is driven by printer and is synchronized to operate at exactly same printing speeds. Printer has speed range of 0 to 25 ft. per minute.—Charles Bruning Co., Inc., 100 Reade St., New York City.

★ ★ ★

TWO NEW MODERN DRAFTING TABLES, Primo Metapost and Metapost, are built of satin chrome tubular steel with baked black Morocco castings. Table tops are selected soft textured pine 1 1/8 in. thick. Reference shelves may be attached to them for use in storing drawings and materials. Table with small base (top 36x54 in., or under) has

MACHINE Finisher Pays Dividends

Right on the Job!



"Whiteman" Cement Floor Finisher will cover 1,000 sq. ft. in 15 minutes!

Denser, More Level Floors Without Dry Topping



"WHITEMAN" Hand Grill TAMPER

You get a denser floor with more even distribution of finer aggregates on the surface, when you prepare the slab with this Grill Tamper. With a good concrete mix, dry topping is unnecessary. The "Whiteman" Tamper knocks heavier aggregates down—leaves a "fat" sufficient for finish. This inexpensive, light-weight, collapsible and adjustable Tamper saves time and money on all types of surfaces. Write today for full information.

The "Whiteman" Precision Finisher will pay for itself many times over, right on the job, for this FASTER method reduces costs. The rotating, adjustable steel trowels of the machine will cover 1,000 sq. ft. in as little as 15 minutes—produce flatter, smoother floors in half the time. You eliminate unnecessary "overtime" expense" for the "Whiteman" Finisher is real insurance against having your floor "get away from you" when extra finishers are not available.

You secure denser, stronger floors with this machine. Your floors are absolutely level, without high or low spots or ripples. No dusting or crazing is possible.

Unequaled for Color Work, the "Whiteman" Precision Finisher presses color in evenly, leaving no light or shaded spots.

The proved performance of this Finisher is evidenced by its successful use at the Douglas Aircraft Corp., Santa Monica; Lockheed Aircraft Corp., Burbank, Alameda Naval Base, Alameda, Calif.; and many other jobs.

There's a dealer near you. Write TODAY for full information.

WHITEMAN

MANUFACTURING COMPANY

3249 Casitas Avenue
Los Angeles, California

HOW to make a Trench-Hoe do double service . . .



. . . for Sewer and Water Trenches —

Hoe operation at best is a good test of machine and operator. Photo tells a very convincing story of how this $\frac{1}{2}$ yard machine, after cleaning away surface dirt, dug down 14' 6" into a heavy clay. Side cutters on bucket plus the excess power and easy operation of the BAY CITY gives a clean, straight walled ditch cut only to the width of the bucket.

. . . for Basement Excavation—

There is a definite trend in many parts of the country toward the BAY CITY equipped with special basement digging Hoe Attachment. Photo illustrates typical small house basement with straight sidewalls, square corners and even graded floor — all excavation done with machine on top. No ramps — no extra digging. Pay dirt from the start.



The snappy swing, fast line speeds, easy operation and added stability that is built into this sturdy, well-balanced $\frac{1}{2}$ yard convertible machine is establishing new performance records on all types of work. The field-proved design from crawlers to boom point combines heavy duty construction with the modern use of alloy steels to reduce unnecessary dead weight, yet retaining the stamina and strength so desirable for long, continuous, low-cost service. If you want BIG MACHINE VALUE in SMALL SHOVELS write for Catalog 25-BC which contains complete specifications, working ranges and machinery description.

BAY CITY SHOVELS, Inc., Bay City, Michigan



BAY CITY

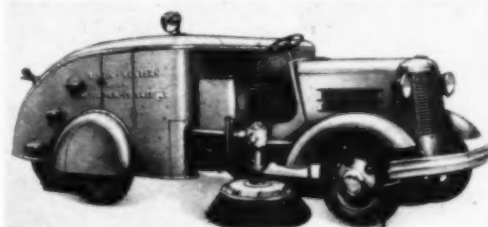
SHOVELS • CRANES • DRAGLINES • TRENCH-HOES • SKIMMERS



21x26-in. shelf. Large base table (top 36x60 in., or more) has shelf measuring 21x39 in. Main feature: ease of adjustment. Primo Metapost is adjusted by turning free operating hand wheel that will raise working surface from 35½ to 43 in. Top may be tilted from front to back at an angle of 60 deg. by adjustment of two hand clamps. Metapost table top is raised by loosening two thumb screws on uprights supporting top and adjusting working surface from 35½ to 43 in.—The Frederick Post Co., Hamlin & Avondale Aves., Chicago, Ill.

★ ★ ★

MOTOR PICK-UP SWEEPER. 2½-cu.yd. capacity, offers to its users, according to manufacturers, improvements in cleaner sweeping, visibility, accessibility and ease of control. Both brooms and self-cleaning beltless elevator are independently raised and lowered by hydraulic power through shifting of small levers, said to save time and effort. Through auxiliary mechanical arrangement, brooms are made to hug pavement without dancing and at same time, they can rise and fall when irregular surface sections are encountered. Two speeds are



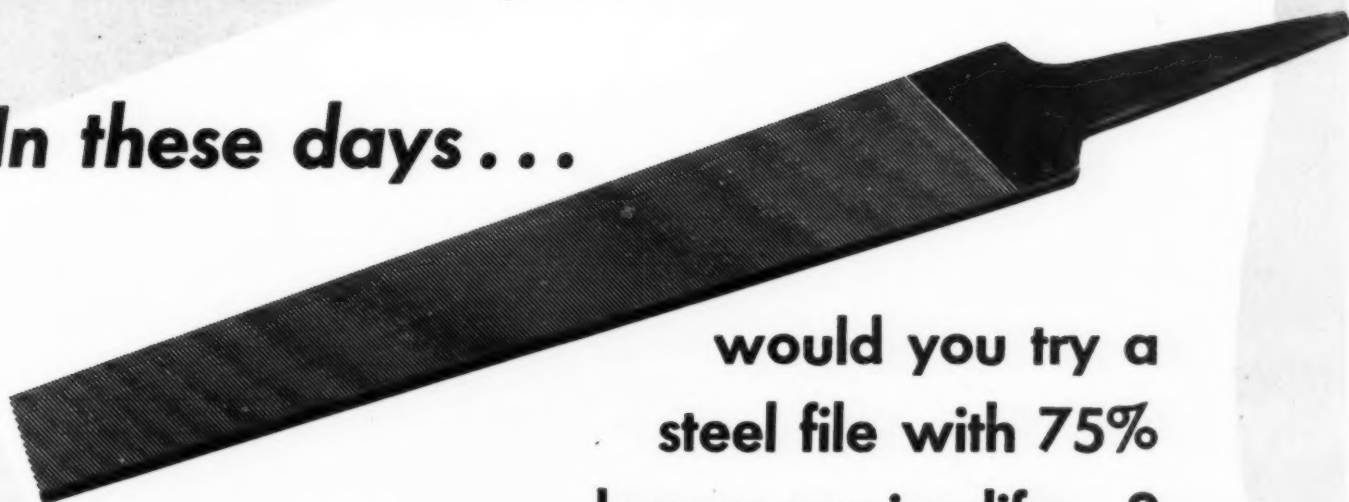
available—one for ordinary and one for difficult sweeping conditions. Four-wheel, reinforced chassis, with solid axles, said to give sweeper truck-like stability and to maintain more accurate alignment of working parts. Other improvements: (1) Headlights have been moved forward from dash to radiator to improve visibility and to reduce night shadows; (2) all wheels have been equipped with mud guards; (3) booster brakes for additional safety; (4) extra foot room and higher floor plate for operator's comfort; (5) newly designed bumper gives more clearance when passing parked cars; (6) doors provide easy accessibility for servicing and inspection; (7) water tank, filling hose, dirt hopper, chains and sprockets completely inclosed.—Austin-Western Road Machinery Co., Aurora, Ill.

★ ★ ★



LAMP GUARD (left) for use on portable extension lights features "water-sealed" socket (above) which increases safety around water, moisture, dust and electrical hazards.—Safeguard Electric Co., Inc., 1 De Kalb Ave., Brooklyn, N. Y.

In these days...



**would you try a
steel file with 75%
longer service-life...?**

Of course you would—because now more than ever before you realize the necessity for both economy and steadier production. And the same principle applies to Hazard LAY-SET Preformed.



HAZARD LAY-SET *Preformed*

● Compared with the service-life of non-preformed rope, Hazard LAY-SET Preformed frequently makes almost unbelievable records. And with good reason, too, because—

Being preformed, LAY-SET possesses extreme resistance to fatigue. That makes it *last longer*. Longer service-life means fewer machine shutdowns for rope replacement. And that means steadier production; more productive man-hours.

Then, too, Hazard LAY-SET Preformed is easier, faster and *safer* for workmen to handle. It is more flexible. It doesn't fight the man who is trying to work with it. Worn and broken crown wires don't wicker out to jab workmen's hands.

Learn the dollar value of Hazard LAY-SET Green Strand by putting a piece on your machine and keeping your own record of comparative performance. All Hazard ropes identified by the Green Strand are made of Improved Plow Steel.

HAZARD WIRE ROPE DIVISION • WILKES-BARRE, PENNSYLVANIA
Established 1846

AMERICAN CHAIN & CABLE COMPANY, INC.

District Offices: New York, Chicago, Philadelphia, Pittsburgh,
Fort Worth, San Francisco, Denver, Los Angeles, Atlanta, Tacoma

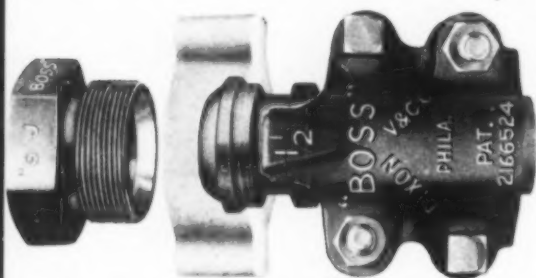


For Unequalled Dependability on STEAM...



AIR...
and
WATER
LINES

HIGH OR LOW PRESSURE



"GJ-BOSS"

GROUND JOINT STYLE X-34
HOSE COUPLING

A washerless coupling that insures important savings in service costs by eliminating all danger of leaks, pressure losses and intermittent shut-downs. Copper insert in spud fits rounded head of steel stem, forming soft-to-hard metal seal that will not leak, regardless of wear or the presence of abrasive particles. Application of strong "BOSS" Offset Interlocking Clamp precludes any possibility of a blow-off. (4-Bolt Clamp on sizes 1" and larger; 2-Bolt Clamp on sizes 7/8" and smaller.) Cadmium plated — rustproof.

"BOSS" WASHER TYPE FEMALE HOSE COUPLING STYLE W-16

Same as above, except that head of stem and coupling end of spud are flat, to accommodate washer. Safe, efficient, economical. Sizes 1/4" to 4", inclusive.

Carried in Stock by Leading
Rubber Manufacturers and Jobbers

DIXON

VALVE & COUPLING CO.

MAIN OFFICE AND FACTORY, PHILADELPHIA, PA.
Branches: Chicago • Birmingham • Los Angeles • Houston

NEW 15-TON TRUCK CRANE completes Northwest line of four cranes ranging in capacity from 4 1/2 to 18 tons. "Feather touch" clutch control said to take fatigue out of operation, shifting clutches through power of engine, yet retaining feel of load. Swing clutches of standard uniform pressure type claimed



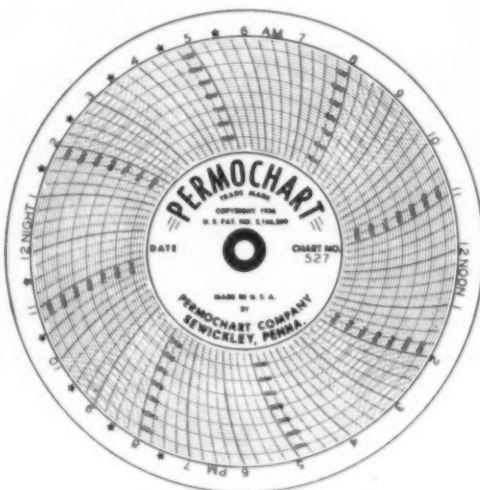
to give exceptionally smooth operation. Cushion clutch said to reduce strains in all parts and to increase machine life. May be equipped with "power up and power down" boom hoist used in raising or lowering boom. Single lever is used to control functions of boom hoisting, boom lowering and braking. Engine throttle control also is provided, allowing engine to be slowed down over wide range. — Northwest Engineering Co., 1728 Steger Bldg., Chicago, Ill.

★ ★ ★

PLASTIC-TYPE PLYWOOD, known as Resnprest, for use in construction of industrial buildings, homes, concrete forms, truck and bus bodies, farm silos and water troughs, is Durez resin bonded plywood, made by spreading solution of phenol formaldehyde resin on both sides of core veneers placed at right angles between back and face of panels. Plywood "sandwich" is then inserted in hot plate presses, moving parts of which weigh 75 tons. Result is plastic product said not to be affected by moisture, temperature, acids, solvents, mold or fungus. — M & M Wood Working Co., Portland, Ore.

★ ★ ★

RECORDING INSTRUMENT CHARTS for continuous use, called Permocharts, are made of Vinylite plastic from surface of which previous day's ink record may be removed with damp cloth. Said not to curl, to be non-flammable and to be oil, gasoline and grease resistant. Because each chart is in use over long period, centers are reinforced to prevent de-

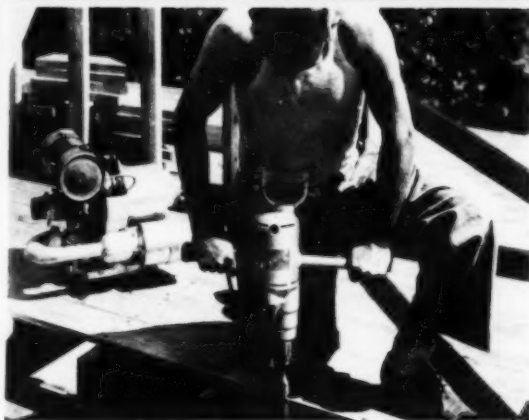


terioration. Printing and laminating have been improved to assure more legibility and less possibility of separating at edges. Makers guarantee charts for daily use for two years under normal working conditions. Made for all types of recording instruments which use circular charts. Of special interest to pipe-line companies, utilities and to other industries where large numbers of such charts are used. Permocharts claimed to reduce costs by 80 per cent, or more.—Permochart Co., 440 Chestnut Road, Sewickley, Pa.

EAST SIDE WEST SIDE

ALL AROUND THE JOB

Handy Portable Power for Electric Tools and Floodlighting



ELECTRIC POWER — WHERE AND WHEN YOU NEED IT

There's nothing like a Homelite Portable Generator for driving electric tools — for convenience, speed and economy. You have no power hook-up costs. No delays. No long, troublesome cables running all over the job. A worker simply picks up the Homelite—complete weight only 83 pounds—and carries it right where he wants to work. He can take it any place on the job. He starts the built-in gasoline engine, plugs in his tools, and works with modern efficiency.



ELECTRIC POWER — AS MUCH AS YOU NEED

In spite of a Homelite's handy, compact size, it gives you 1800 watts with an automatically controlled 110 voltage. You can run several electric hand tools or floodlights at a time. And you have enough power to push your tools right up to peak capacity.

Send for Bulletin

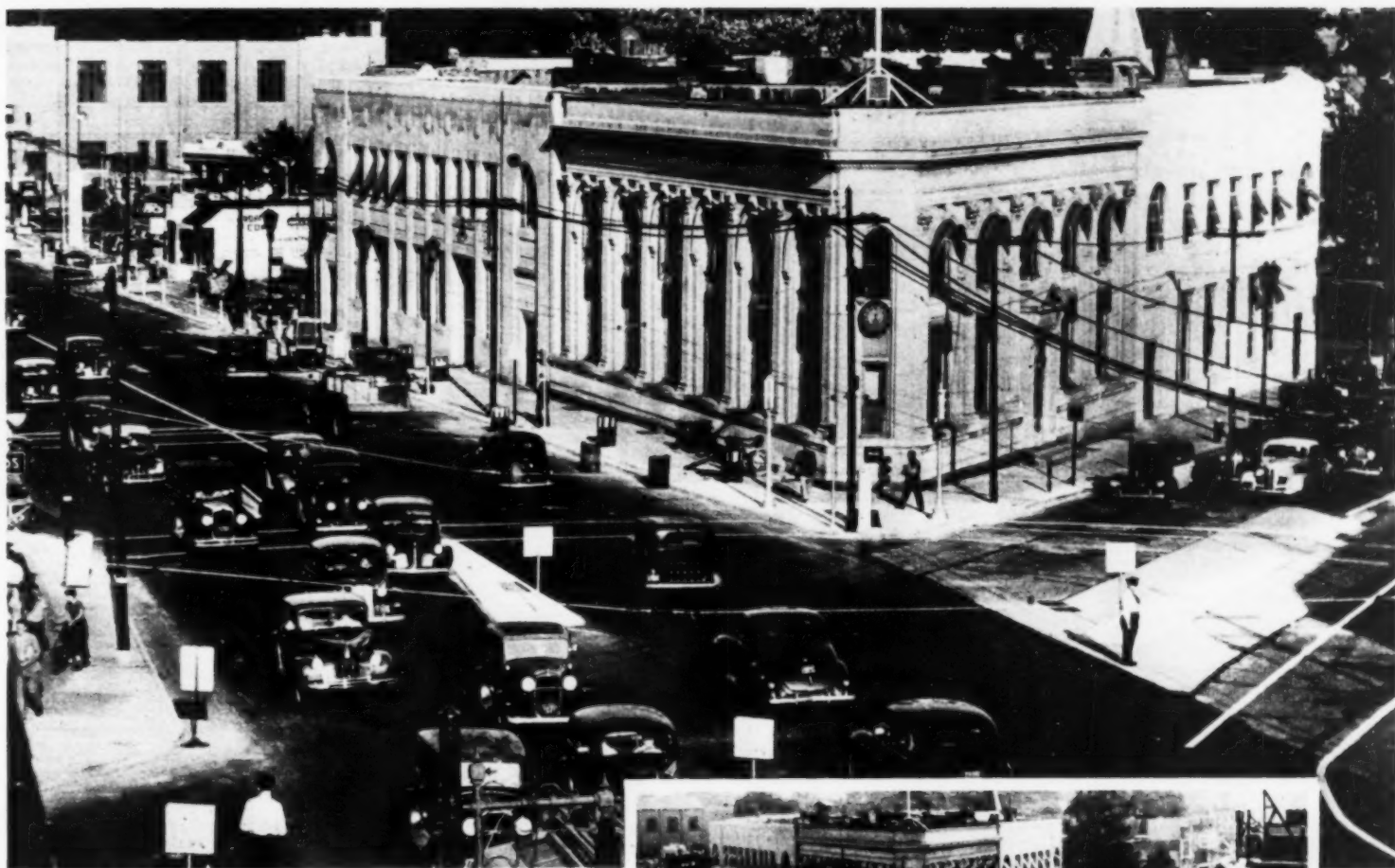
Get the new Homelite Portable Generator bulletin giving complete descriptions of all models—sizes, weights and capacities—as well as all their valuable uses.



HOMELITE

CORPORATION

1804 Riverdale Avenue, Port Chester, N. Y.



SPRINGFIELD AVE., Irvington, N. J.
COUNTY ENGINEER: William A. Stickle
GENERAL CONTRACTOR: Franklin Contracting Co., Newark, N. J.
EXCAVATION AND CONCRETE CONTRACTOR: Thomas Gallo, Newark, N.J.



You can't just close down "MAIN STREET"

When it is necessary to obstruct the traffic of a busy street or a heavily traveled highway, your motto wants to be, "Make it snappy!"

So thought the County Engineer when faced with the need to widen and re-pave Springfield Avenue, Irvington, N. J., and at the same time handle a daily traffic load of 40,000 pedestrians and 28,000 vehicles without undue inconvenience.

To get the paving done in the quickest possible time and with the least interruption to traffic, he specified early

strength concrete. By the use of Lehigh Early Strength Cement, the concrete in each roadway section was ready for traffic in 24 hours. *That* quickly, too, the contractor was able to move materials and equipment over a completed section to start work on another one.

Not only on concrete jobs involving the public convenience, but on all jobs where quicker completion means economy to you, specify Lehigh Early Strength Cement. Making concrete of usable strength 3 to 5 times faster than normal cement, it brings outstanding advantages to all forms of concrete work.

For more information about the cement that makes better, denser concrete—and makes it quicker—write the Lehigh Service Department.

Lehigh **EARLY STRENGTH CEMENT**

LEHIGH PORTLAND CEMENT COMPANY • ALLENTOWN, PA. • CHICAGO, ILL. • SPOKANE, WASH.

MICHIGAN mobile CRANES

Speed Construction!

Setting costly marble on a new office building might not be a defense project. But, the mobile, rubber mounted crane that's able to do this precision job at high speed makes light work of countless construction operations calling for action, and plenty of it! Positive, smooth MICHIGAN Air Controls (proven by ten years successful use) permit operators to work swiftly and safely, within fractions of inches. MICHIGAN'S advanced frame design gives low gravity center to entire machine, providing utmost stability for fast, efficient crane work. Ten large pneumatic tires distribute weight evenly, lowering unit ground pressures. The MICHIGAN CRANE gets around with truck mobility — to and from the job in a hurry, handling work of more than one ordinary machine. Heavy duty motors provide ample power for heavy lifts. . . . MICHIGAN Tandem-Drive Mobile CRANES, fully convertible to all standard attachments*, may be the profitable answer to your problem of meeting today's exacting schedules — Bulletin CM-14 shows how modern MICHIGANS speed construction on many fronts—write for it TODAY!



*Rigged as Shovel, Dragline or Trench Hoe, MICHIGAN'S "fast-pace production" will earn real profits for you from a broad range of work!

3/8 YD
1/2 YD

1/4-YD. EXCAVATOR. featuring sustained high output at low operating and maintenance costs, has been made easily convertible in field from shovel to dragline, crane or drag shovel by simplifying front end construction. Powered by 54-hp. gasoline engine with specially designed carburetor and manifold said to provide peak efficiency under rapid load fluctuations. Diesel and electric power also available. Proportion of power and speed in hoist, crowd and swing balanced for fast digging. Direct action clutches said to give operator accurate,



smooth control over every phase of digging cycle. Boom hoist lever located in main lever bank in front of operator, giving independent high speed, power-controlled raising or lowering. For shovel operations positive independent twin rope crowd provides powerful crowdout with two ropes sharing load. All gears except swing-rack and pinion, are completely inclosed and run in oil. Positive digging lock, controlled by single lever from operator's seat, permits: (1) Free motion in either direction; (2) locking against motion in both directions, and (3) locking against motion in one direction but permitting motion in other. Treads 16-in. wide provide area of 21.5 sq.ft. for firm footing.—Bucyrus-Erie Co., South Milwaukee, Wis.

★ ★ ★

IMPROVED DIESEL MOTOR GRADER is equipped with 62½-hp. diesel engine which is started as gasoline unit and, after brief warming period, is converted into full-diesel engine by throwing lever in operator's cab. Equipped with new cab which features operator's seat adjustable backward and forward for "standup" and "sit down" operation and also to convenient height. Other features: (1) Adjustable steering wheel; (2) improved governor



control permitting positive and sensitive control of engine speeds while providing full governor action at all speeds; (3) tandem-drive machines equipped with new, self-energizing Bendix hydraulic brakes, said to provide quicker and more positive brake action; (4) twin-lever steering gear operated with ball and tapered roller bearings for easier steering; (5) adjustable lift links provide higher blade clearance when desirable, permit wider shoulder reach outside line of wheels and assure lower or flatter backslope cuts. Standard equipment includes 12-ft. blade, leaning front wheels with 7.00x24-in. rib-tread tires; tandem drive with four 12.75x24-in. ground-grip, low pressure tires. Travel speeds may be adjusted to almost any point between one and 18 m.p.h.—J. D. Adams Co., Indianapolis, Ind.

MICHIGAN America's Mobile Shovel-Crane Specialists
MICHIGAN POWER SHOVEL CO.
BENTON HARBOR MICHIGAN



GMC POWER

Takes Hills Faster

Save Time ... Cut Gas Costs with these Stronger-Pulling Low-Priced Trucks!

THAT EXTRA MARGIN OF POWER makes a General Motors Truck the best performer on any haul. You not only save time on hills, but often pull through in a higher gear than you ever used before. And you also save gas! That's because a GMC develops its greater pulling power by burning fuel *more efficiently*—not by burning more of it. The secret is the GMC Turbo-Top Piston,

pictured above, and the revolutionary combustion chamber it forms in the GMC engine. No other truck engine is like it. And no other truck gives you so many additional engineering advancements. GMC Ball-Bearing Steering saves as much as 57% of the work at the wheel. Cradle-Coil Seats give the GMC driver the most comfortable ride of any truck. Try a GENERAL MOTORS TRUCK today!

Our own YMAC Time Payment Plan assures you of lowest available rates



Drivers say that GMC Ball-Bearing Steering is the greatest comfort and safety development since the pneumatic tire.

AMERICA'S *Low-Priced Truck of Value* **GMC** TRUCKS... *Gasoline·Diesel*



WILLIAMS' STRUCTURAL WRENCHES ARE YOUR SAFEST BET

A long record of unfailing performance has made Williams' Structural Wrenches practically standard equipment with experienced steel workers everywhere. These wrenches have long narrow jaws which provide substantially full bearing on square nuts. The abrupt offset and angle of the handle assure clearance of obstructions and safety for the operator's hands. Openings, for U. S. Standard sizes, are milled slightly over-size to accommodate rough bolts and nuts.

Williams' Structural Wrenches are made from both carbon and alloy steel in a full range of sizes. Both types provide a particularly well-balanced wrench, fast and easy to use and easily carried in scabbard or belt loop.

All Williams' Wrenches are fully guaranteed and are sold by industrial distributors everywhere.



FOUR-WHEEL PIPE CUTTER with increased cutting speed and for use in close quarters has capacity $\frac{1}{2}$ to 2 in. Four wheels said to provide better balance and easier handling of cutter under all conditions. Also claimed to cut more evenly and to save time in cutting iron, steel or brass pipe.—**The Ridge Tool Co., Elyria, Ohio**

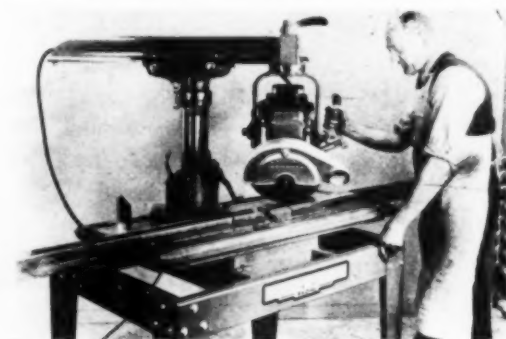
★ ★ ★



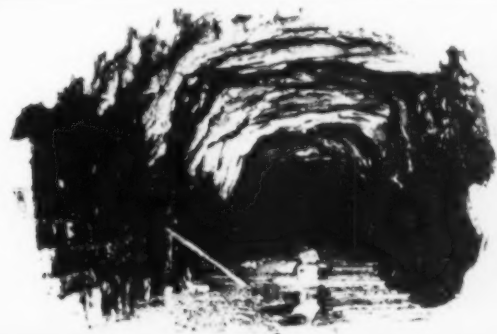
PORTABLE HOIST, new addition to "Pul-Lift" line, has capacity of $4\frac{1}{2}$ tons, offering range of capacities from $\frac{3}{4}$ to 6 tons. Intermediate sizes have capacities of $1\frac{1}{2}$, 3 and $4\frac{1}{2}$ tons. New hoist is said to be light in weight, making it easily portable, yet strong and rugged enough to care for jobs within rated capacity. Roller chain used is claimed to have five times rated capacity of hoist. Operates equally well in horizontal or vertical position. Another feature: Yale safety hooks which, in case of severe overload, open slowly, without fracture, said to give ample visual warning of danger and positive protection to operator, load and mechanism. For operation in tight out-of-way places "Pul-Lift" has ratchet handle with universal action.—**The Yale & Towne Mfg. Co., Philadelphia, Pa.**

★ ★ ★

RADIAL CUTTING MACHINE, for cutting plastics, stainless steel pipe, asbestos-cement composition sheets and pipes, angle iron, steel, copper tubing, porcelain insulators and other materials used in maintenance and construction, is claimed by its manufacturers to be able to handle this diversity of cutting jobs because of three features: (1) Shock-proof, geared motor which gets shaft close to work,



Once they called it "VANDERBILT'S FOLLY"



FIFTY YEARS AGO William Vanderbilt started to build a railroad through the Alleghenies. \$10,000,000 was spent grading, drilling and blasting through the mountains. Then work ceased.

The roadbed, on which 3,000 men had worked, was left to the ravages of time. Tunnels caved in. Erosion gnawed away at the steep gradings. And in 1890 "Vanderbilt's Folly" was sold by the sheriff.

Three years ago the rights to this roadway were bought. Work was resumed—only this time to build the world's finest highway, the Pennsylvania Turnpike.

Today you can drive 160 miles without an intersection to worry you. And two-thirds of the road is straightaway, with no grade steeper than 3%.

Du Pont played a small part in the building of this modern speedway. Du Pont powder was used, and Du Pont "Ventube"* was supplied for ventilating part of the seven miles of tunneling which had to be drilled through the mountains. The picture below shows "Ventube" in use on the Laurel Hill Tunnel job, which was completed by the Hunkin-Conkey Construction Company *in record time*. Another *big* job where "Ventube" helped speed work ahead!

*"Ventube" is Du Pont's registered trademark for its rubber impregnated flexible ventilating duct.



The flexible ventilating duct

E. I. DU PONT DE NEMOURS & CO. (INC.)
"FABRIKOID" DIV. • FAIRFIELD, CONN.

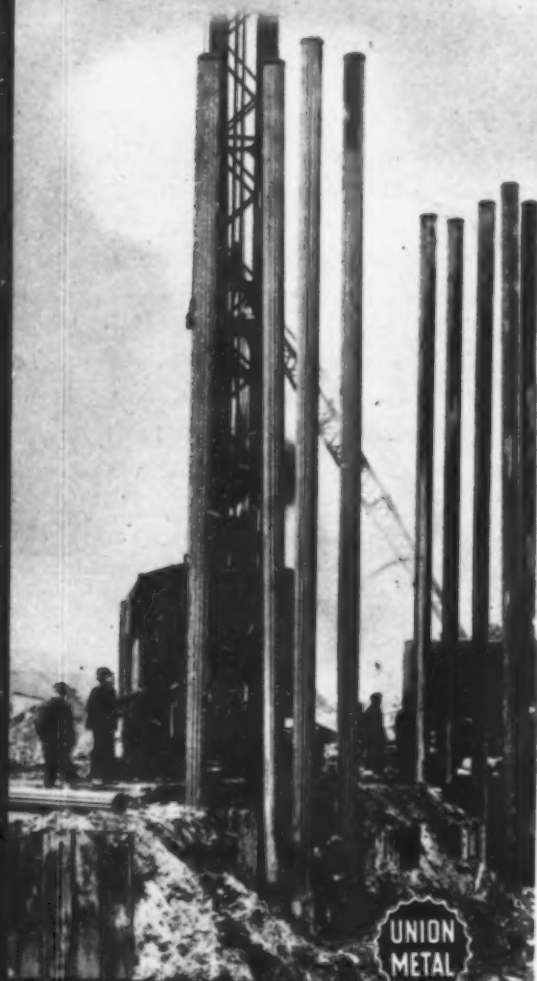
MONOTUBES

will go to
ANY LENGTH

to Solve a Foundation Problem

• This industrial plant addition called for 216 piles from 72 to 80 ft. in length. Five piles were to be used in each of the principal footings, which were designed to carry a load from 250 to 260 tons. The 7 ga. Monotubes selected were driven in two sections. The contractor first drove the lower 40 ft. in a footing, then attached the second section by means of a field splice and drove to final penetration. All Monotubes were driven with crawler cranes equipped with standard leads and hammer. The perfect alignment and plumbness of the partially driven Monotubes illustrated, testifies to the quality of their work.

Monotubes combine strength, safety and savings with speed of installation. They are light weight for easy handling; require no mandrel; can be driven speedily with standard equipment; and may be inspected thoroughly before concreting. For complete information on this modern method of pile construction, write for copy of Catalog No. 68A.



**THE UNION METAL
MANUFACTURING CO.**
CANTON, OHIO

permitting use of smaller blades and thus obtaining greater rim, or cutting, force; (2) sliding ram which allows operator unobstructed view of work; (3) double yoke in which motor is suspended, making it possible to use machine for cross-cutting, ripping, both left and right, mitering at both simple and compound angles, shaping, dadoing, routing and tenoning. May be used either for wet or dry cutting.—Walker-Turner Co., Inc., Plainfield, N. J.

★ ★ ★

ON-CENTER SAFETY GOGGLE of spectacle type include following features: (1) Double-braced bridge developed for hard usage; (2) design that conforms to orbit of eye; (3) comfortable rocking pads; (4) insulated, heat-resisting, perspiration-proof



temples; (5) three eye and bridge sizes; (6) Super Armorplate clear or Calobar lenses. Goggle may be obtained with wire-mesh side shields said to give extra protection against particles striking from sides. Screens non-corrosive and easily cleaned.—American Optical Co., Southbridge, Mass.

★ ★ ★

GYPSUM WALLBOARD under trade name of Best-wall, is produced with all four edges beveled, making possible concealment of side, as well as end joints. When two pieces of this wallboard are placed together, two bevels form depression in which reinforcing tape is applied. Tape then is covered with joint finisher, forming smooth, strong joint. One of chief advantages claimed is elimination of much of "feathering out" formerly necessary in finishing ends of applied boards, thereby saving time and labor. Furthermore, by permitting horizontal applications, four-bevel product supplies additional bracing and provides greater strength to joints at all openings and corners.—Certain-teed Products Corp., 100 E. 42nd St., New York City.

★ ★ ★

16-CU.YD. SCRAPER. "Dig-N-Carry" model, is shown carrying load of stone on state highway grading job in Indiana. Manufacturers list following construction features which contribute to unit's efficiency: (1) Cutting width (including side routers) of 9 ft. 8 in.; cutting depth of 0 to 6 in., and spreading depth of 0 to 18 in.; (2) Semi-floating, fast-acting gate said to assure unloading action so fast and



positive that under ordinary operating conditions (except in extremely sticky soil) scraper unloads while tractor is pulling unit at top speed. Complete system includes following assemblies: (1) Power take-off adapter, rotary gear pump and control lever assembly mounted on tractor; (2) control valve assembly; (3) oil supply tank; (4) anti-settle check

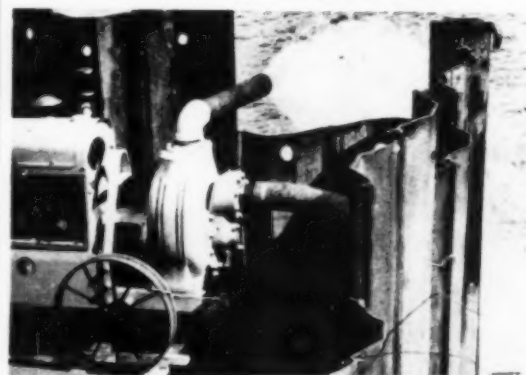


BUILT TO TRAVEL BUILT TO LAST!

New model 10S shown has air cooled V-Type Engine giving added power—with less weight. CMC offers a complete line of trailers up to 14S to meet every job need. More profits for you with "Speedmixing" CMC performance.



DUAL PRIME CENTRIFUGAL PUMPS!



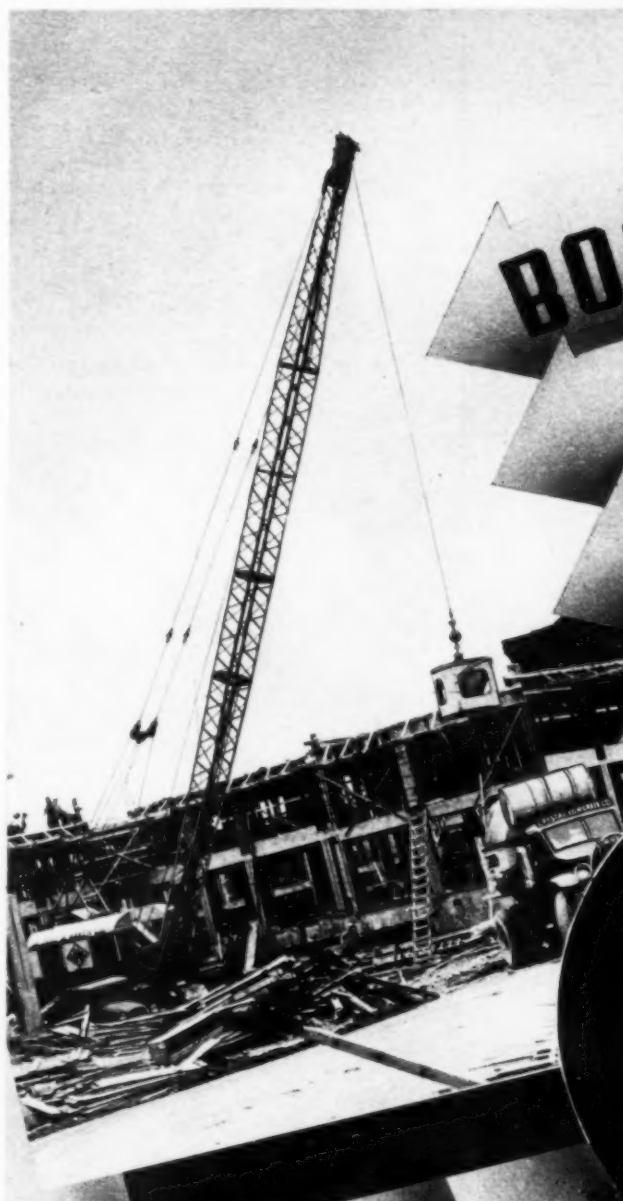
40-M CMC pumping 40,000 GPH on bridge job. A standout pump for all around service.

Doubly fast—doubly sure. Only CMC has dual prime. Sizes up to 10"—unbeatable in performance, stamina, dependability.

NEW CMC CATALOG!

See what's new and better in Concrete Mixers, Hoe-Type Mixers, Batching Equipment, Pumps, Hoists, Power Saws, Carts, Barrows!

**CONSTRUCTION
MACHINERY CO.**
WATERLOO, IOWA



BOOM UP or DOWN
SWING
TRAVEL
HOIST

All at the Same Time

with Lima

Are you getting the maximum service from your crane or are you working at a disadvantage because your crane does not have independent clutches? LIMA cranes get lifting jobs done swiftly and economically because all major operations can be performed simultaneously. By this, we mean, it is possible to hoist, travel, swing, or boom up or down at the same time. Instant response is always to be had at the slightest

motion of the control levers because no time is lost engaging or disengaging jaw clutches to accomplish any of the different operations. Imagine too what this important feature means when maneuvering in close quarters or where it is necessary to hoist the load, swing, travel and boom at the same time. LIMA cranes of 18 tons capacity and larger give you this advantage. Make your next crane a LIMA and get more value for your money.

LIMA LOCOMOTIVE WORKS, INCORPORATED, SHOVEL and CRANE DIVISION, LIMA, OHIO
NEWARK, N. J. NEW YORK, N. Y. DALLAS, TEX. MEMPHIS, TENN. PHILADELPHIA, PA. SEATTLE, WASH. VANCOUVER, B. C. PORTLAND, ORE. MONTREAL, QUEBEC, CAN. LOS ANGELES, CALIF.

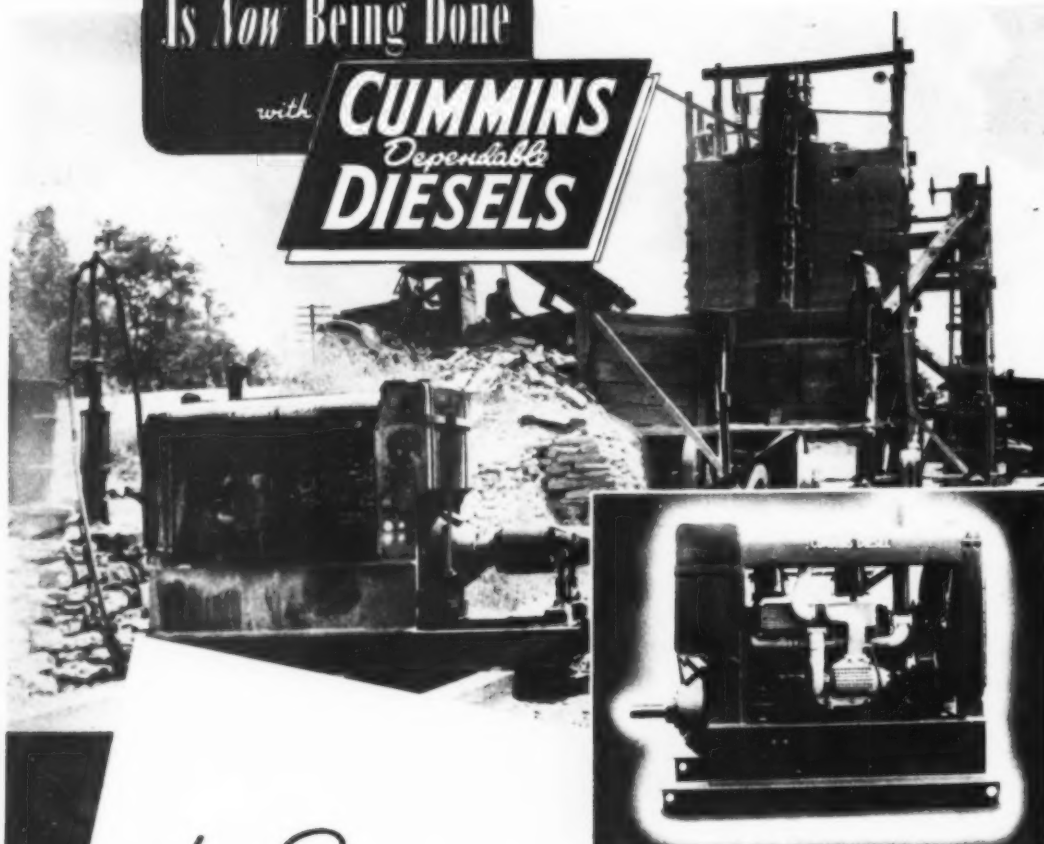
LIMA SHOVELS DRAGLINES CRANES

SHOVELS, $\frac{3}{4}$ YD. to $3\frac{1}{2}$ YDS. DRAGLINES, VARIABLE

CRANES, 13 TONS to 60 TONS

The Job
You Want Done
Is Now Being Done

with **CUMMINS**
Dependable
DIESELS



ABOVE: Model HPS-600 (supercharged) Cummins Dependable Diesel. 200 hp. at 1800 rpm.

for Example

The Blue Grass Stone Company, Lexington, Kentucky, produces crushed rock for local contractors. Early in 1939, when a Model HP-601 Cummins Diesel (150 hp. at 1800 rpm.) replaced a coal oil engine, fuel consumption dropped from 65 gallons to 26 gallons per 10-hour day. . . production costs fell to 1½¢ per ton. Foreman Ryburn Hostetter says that the Cummins Diesel "has plenty of power, the harder the pull the more power it seems to have . . . when it was six below, pressed the button and away she went." The Cummins Diesel's operating economy, flexibility, proved dependability and all-weather instant starting are four important reasons why nationally-known operators of all types of heavy-duty equipment specify Cummins Dependable Diesels. Cummins Engine Company, 1716 Wilson Street, Columbus, Indiana.

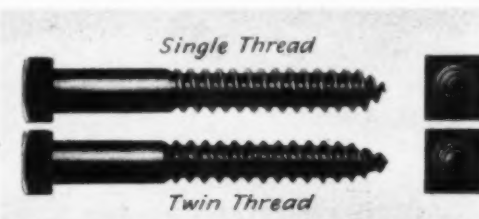
valve; (5) three hydraulic hoists mounted on scraper frame. Of three hoists, one raises and lowers scraper bowl, one opens and closes front gate and third operates rear push-out apron. Three control levers mounted on back of tractor seat handy to operator enable him merely to move these levers forward or back to raise or lower hoist pistons—**The Heil Co., Milwaukee, Wis.**

★ ★ ★

TWIN-THREAD LAG BOLT is designed to turn down twice as fast as a single-thread bolt. Improved bolt has long-tapered, self-centering point and full, sharp threads. In accompanying illustration, note how strings wound around threads of old and new types



of lag bolt indicate sharper helix angle, quicker taper at end and double thread of new bolt. With one turn the new twin-thread bolt penetrates twice as far into wood as does old single-thread bolt. Has 10 per cent greater thread area than old bolt



and draws up tighter because threads cut deeper, making tighter assembly. New bolt can be used with single-thread type of soft expansion shields for masonry work. Available in diameters from ¼ to 1 in. and in lengths, with square heads, of from 1 to 16 in.—**Lamson & Sessions Co., Cleveland, Ohio.**

★ ★ ★

STREAMLINED, ALL-WELDED DRAGLINE BUCKET, for general service and named "Biglode," has as principal features "balanced" construction for easier handling, simplified design—arch, body, hitch plates, bucket lip and runners welded into single



P&H PROVED

1600 Times Over!



~~1600~~
~~1500~~

OF THE TOUGHEST
EXCAVATORS EVER
BUILT—THAT'S P&H
ROLLED STEEL
DESIGN

S-M-O-O-T-H as steam—P&H's
new hydraulic control. Try it!

ANY way you look at it, that's a lot of evidence! And it's piling up on all sides. Users by the hundreds are discovering the extra advantages in P&H's tougher rolled steel construction.

Other excavator builders are recognizing it, too. Ultimately, we predict, the entire industry will turn to this more practical and modern design. But why wait until then?

General Offices: 4404 W. National Avenue, Milwaukee, Wisconsin

HARNISCHFEGER
CORPORATION

EXCAVATORS • ELECTRIC CRANES • ARC WELDERS  HOISTS • WELDING ELECTRODES • MOTORS



SHOOTING THE TOE- PROFITABLY



With Primacord, you can detonate a large number of small under-cut holes placed at very close intervals—a very profitable feature when you're shooting the toe in conjunction with well drill holes.

Primacord-Bickford is an insensitive detonating fuse. Its core of PETN, within a flexible, waterproof textile cover, carries the detonating wave at nearly 4 miles per second. Yet the fuse cannot be exploded by fire, friction, or any ordinary shock but must be detonated with fuse and cap or electric blasting cap.

PB31

PRIMACORD BICKFORD Detonating Fuse

THE ENSIGN-BICKFORD CO.
SIMSBURY, CONN.

Makers of Cordeau-Bickford
Detonating Fuse—and Safety
Fuse since 1836

unit—to provide greater strength, and flared lip-and-teeth assembly to assure digging action similar to that of round nose shovel. Hitching is said to be simplified, conventional number of hitching parts being reduced to less than half and chain kinking being eliminated. In addition, old hoist cables may be used for dumping cables, and drag cable can be replaced without removing pins. Full manganese teeth have reversible points. Available in capacities from $\frac{3}{8}$ to 4 cu.yd.—Harnischfeger Corp., Milwaukee, Wis.

★ ★ ★

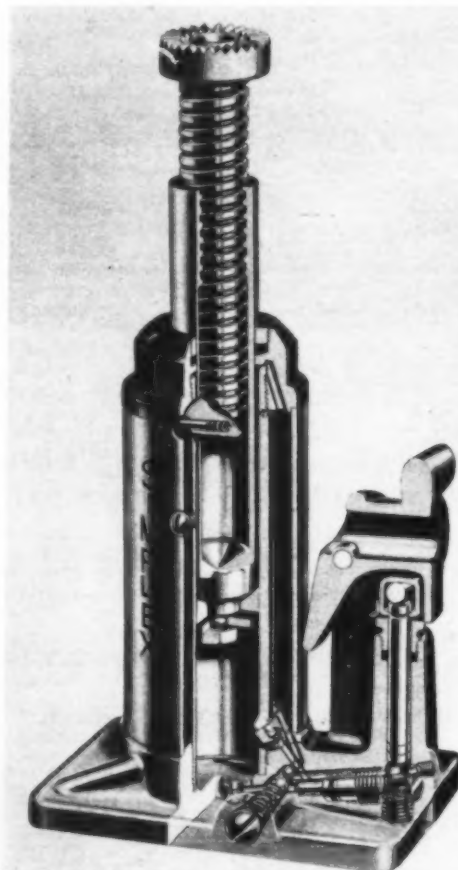
1/4-IN. STANDARD BALL-BEARING DRILL is production unit said to be high powered, compact and lightweight. Equipped with anti-friction bearings throughout, splined gear mounting, locked inner



and outer races on spindle bearing and removable commutator end cover. Close offset and choice of end or side handle. Drilling capacity in steel is $\frac{1}{4}$ in.; in hard wood, $\frac{1}{2}$ in. Standard speed is 2,000 r.p.m. Available, also, in speeds of 3,500 and 5,000 r.p.m.—Black & Decker Mfg. Towson, Md.

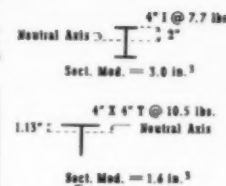
★ ★ ★

HEAVY-DUTY HYDRAULIC JACKS are made in 3-, 5-, 8-, 12- and 20-ton capacities and incorporate following design and construction advantages: Neoprene oil resistant seals, pressure-tested malleable iron top nut and base, machine ground ram, fully lapped cylinder, ball-type valves, needle type load



IMPROVED LINER PLATES

Speed TUNNEL WORK!



The greater load carrying capacity of an I-beam compared to the much heavier T-beam explains the greater strength with less weight of ARMCO Liner Plates. The design makes the difference.

You can speed the work and save tunneling dollars by using ARMCO Liner Plates. And you do it at no sacrifice of needed strength or safety.

ARMCO Plates are designed to carry the load. This way excess weight is eliminated and one man can easily handle the corrugated metal sections. On a strength-weight basis, ARMCO Plates cost less than any other type. In many cases you actually buy fewer plates. ARMCO's unique design permits spacing the plates to take advantage of partly self-supporting ground. You'll find too that ARMCO Plates are easy to stack and store—a big advantage where space is limited.

Three types of ARMCO Liner Plates are available in a wide range of gages. There is a size to exactly fit any diameter tunnel you need. Try ARMCO Plates on your next job and judge for yourself their many time- and money-saving features. Write for prices and complete information. ARMCO DRAINAGE PRODUCTS ASSOCIATION, 5043 Curtis Street, Middletown, Ohio.



Armco

TUNNEL LINER PLATES

Top-Notch

ANY WAY YOU FIGURE THEM...



THE quick adaptability of Adams Leaning Wheel Graders to every job, their easy operation, and their capacity for hard work, gives them a "top-notch" rating among thousands of users who are familiar with all other makes. Available in 8, 10, and 12-ft. sizes—either hand or power-operated.

Because of their distinctive frame, front axle, and plow beam design, Adams Elevating Graders enjoy the same rating on all types of road and dirt-moving projects. Available in 42-in. and 48-in. carrier sizes, fully power-operated.

Space here does not permit a good start at telling you of all of the work-producing, money-saving features of these machines. If you have need for equipment of this type please let your local Adams representative tell you the complete story or write for catalogs.



Upper illustration shows 12-ft. leaning wheel grader with power-operated controls and pneumatic tires—the deluxe machine of all leaning wheel graders . . . Lower illustration shows elevating grader making cut on road building job. These machines also available with pneumatic tires.

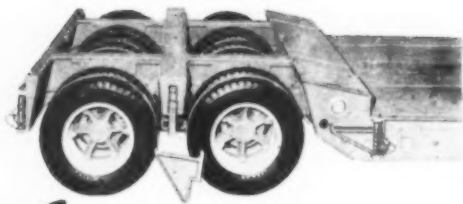
J. D. ADAMS COMPANY • INDIANAPOLIS, IND.

Motor Graders, Leaning Wheel Graders, Elevating Graders, Hauling Scrapers, Retread Pavers, Road Maintainers, Etc.

ADAMS

LEANING WHEEL GRADERS ELEVATING GRADERS

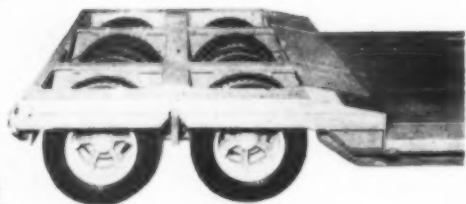
HOW ROGERS



● Rogers builds trailers, conforming to the 8 ft. legal limit of many states, in capacities up to 60 tons—but they need not be limited to 8 ft. loads.

Welded steel brackets shown above may be swung out in a few seconds to receive side members.

EXPANDS *trailer* USEFULNESS



● Above is shown the newly improved design of expandable trailer—with 20 side brackets supporting non-skid wooden side members—an 8 ft. trailer expanded to 10 feet.

After hauling an extra wide load the side members are removed and the brackets folded compactly against the trailer, which returns more quickly than would otherwise be possible.



EXPERIENCE
...built it

PERFORMANCE
...sold it

ROGERS BROS. CORP.
220 ORCHARD ST. • ALBION, PA.

DREDGING *proves it*

Any clamshell that will dig under water as the Haiss Hi-Power does 's got what it takes. You can make money with one on ANY job. Write or wire for prices. All sizes.

HAISS Hi-Power

FOR PAY LOAD CLAMSHELL DIGGING



In stock at New York, Philadelphia, Baltimore, Birmingham, Atlanta, Hartford and Los Angeles
GEORGE HAISS MFG. CO., INC., 139th ST. & CANAL PLACE, NEW YORK—DISTRIBUTORS EVERYWHERE

release, center ram for proper balance and convenient carrying case. Operating features include lower closed height, higher raised height, lighter weight, leakproof design and provision for operation in either vertical or horizontal position. Tested to one and one-half times their capacity to insure satisfactory operation and safety for operator and load.—Templeton, Kenly & Co., Chicago, Ill.

★ ★ ★

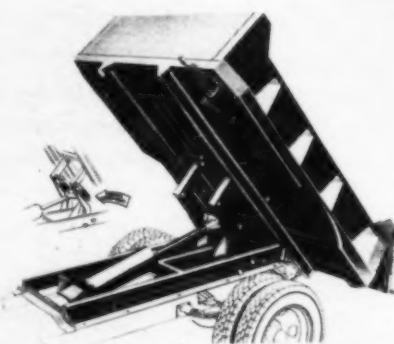
RECHARGEABLE FLASHLIGHT STORAGE BATTERY for use with all two-cell 1 1/4-in. size D flashlight bases, is said to perform heavy-duty service, to be dependable, long lived and economical. In heavy-duty use one discharge is equal to pair of ordinary dry cells. Rechargeable feature makes it convenient to use only while light is bright, charging again when light gets dim. Arrangement of chamber and vent plus semi-fixation of electrolyte makes bat-



tery spill-proof. Plates are more than 1/4 in. thick and connected to terminals by reinforced electrodes. Transparent Lucite case. Small charger consisting of transformer and rectifier plates said to facilitate full charging of battery merely by plugging into 110-v., 60-cycle wall socket. Recommended charging time is 12 hr. for which cost is said to be only 1/10 of 1c. per charge based on 5c. kilowatt hour rate. Clip also available for charging from 6-v. automobile battery. Of particular use to plant maintenance men, watchmen, repairmen, railroad companies and army and navy departments.—Ideal Commutator Dresser Co., 4102 Park Ave., Sycamore, Ill.

★ ★ ★

SPECIAL RUBBER INSETS said to be light in weight and positive in operation, are now being used instead of chains and springs in line of Super Hoist dump bodies to prevent overrun and kick back



when dumping load or spreading gravel. Other features of Anthony low-mounted hydraulic hoist dump bodies are: Low loading height, "push-pull" dash control that works like choke button, telescopic subframe and double arm power-speed hoist.—Anthony Co., Streator, Ill.



**"WHAT A BEATIN'
THIS BABY
TAKES"**

**Keep your heavy-duty
equipment rolling, on
SHELL RUDIS OIL**

"In and out of the pit 12 times a day, and no time out for a breather. You can't handle a truck with kid gloves on that kind of a schedule."

Sissy oils fold up when the going gets tough, but not the new Shell Rudis Oil. Tested in the laboratory, in test engines, on the road under the most severe driving conditions, Shell Rudis Oil has come out on top on every count.

These tests, made by competent, independent engine authorities, prove that the new Shell Rudis Oil . . .

- 1—Has high oxidation stability under the most severe temperature conditions.
- 2—Keeps rings and pistons free.
- 3—Is non-corrosive to bearing metals.
- 4—Reduces sludge formation.
- 5—Cuts down engine wear.

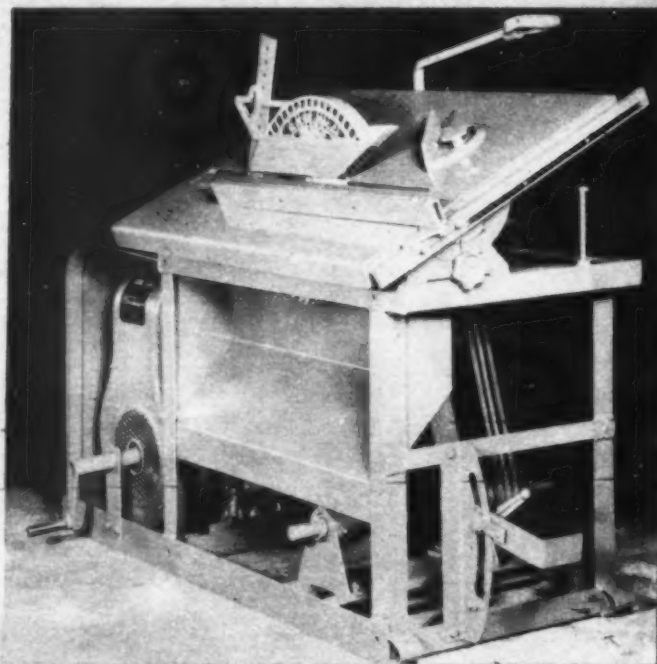
Start saving with Rudis today. Investigate!

NEW SHELL RUDIS OIL FOR HEAVY DUTY

ANNOUNCING the NEW **C.H.&E.** No. 31 SAW RIG

- TILTING TABLE
- SWINGING ARBOR
- BALL BEARING
- ALL STEEL CONSTRUCTION
- V BELT DRIVE
- 4 INCH RIPPING
- 5 H.P. & 8 H.P. ENGINES
- BAND SAW AND JOINTER ATTACHMENTS

\$345



C.H.& E. MANUFACTURING CO.
3847 No. PALMER ST., MILWAUKEE, WIS.

CHROME PLATED STEEL TAPES, engineers' pattern, 1/4-in. width, are offered in two weights, sturdy medium and extra heavy, both marked feet, 10ths and 100ths feet and feet, inches and 8ths. Markings,



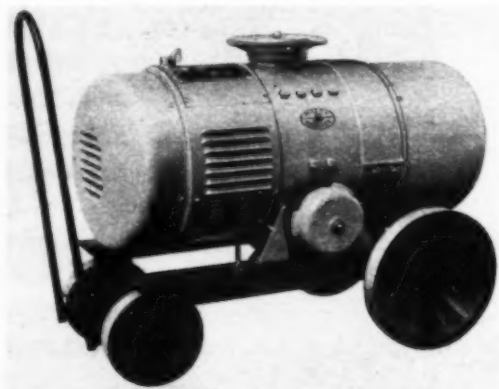
jet black on satin chrome-white surface, said to be not only easy to read but also extra durable. Chrome plating makes lines rust resisting and gives them surface hard, smooth and easily cleaned. Cases, reels and frames of improved patterns.—The Lufkin Rule Co., Saginaw, Mich.

★ ★ ★

SYNTHETIC RUBBER COMPOUND, said to retain adhesive, elastic and waterproofing qualities permanently, is used for calking, sealing cracks, waterproofing, installing structural glass, sealing road and pipe joints and for laying linoleum, cork flooring, wall panels, tile, slate and flagstone. Claimed to grip like vise, not to deteriorate from exposure to weather and to be resilient to expansion and contraction of other materials. Said not to powder, become brittle, crack or otherwise disintegrate and to adhere permanently to wood, stone, brick, concrete, metal, glass and other surfaces. Supplied either in cartridges for use with special convertible cartridge gun or in 1- or 5-gal. drums.—American Bar Lock Co., Long Island City, N. Y.

★ ★ ★

DUAL VOLTAGE SWITCH for installation on arc-welding machines, such as Wilson "Hornet," when they are used on either of two line voltages at different times. May be used on any motor employing a.c. current, provided motor and starter are reconnectable for two voltages. Normally, adjusting motor so that it will operate at different line voltage



takes from 1/2 to 2 hr. With switch installed, charge may be made in less than minute. Switch has two main parts: base mounted directly on machine and removable top cover which has three equally spaced tabs fitting between bosses on base. Cover may be set on base in two different positions, each corresponding to line voltage. In adapting switch, center nut and top cover are loosened until desired line voltage figures are visible. Switch then is locked in position for safety. Designed for 220-440-v. of delta connected motor.—Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York City.



**"WILLIAMS BUCKETS...
ARE SURE EASY ON ROPE"**

... writes a veteran crane operator who has been swinging

buckets for 10 years. There's a reason! Williams sheave assembly, with sheaves set askew (see illustration), keeps leads straight, reducing friction and fraying. Cable lasts longer. Sheave block is protected against contact with bucket load; open ends guard against clogging and abrasive wear. Williams special Welded Rolled Steel Construction also increases strength and improves balance of bucket. A Williams insures faster work, cleaner dumping, more yardage, and operates for years practically free of costs for maintenance and repairs.

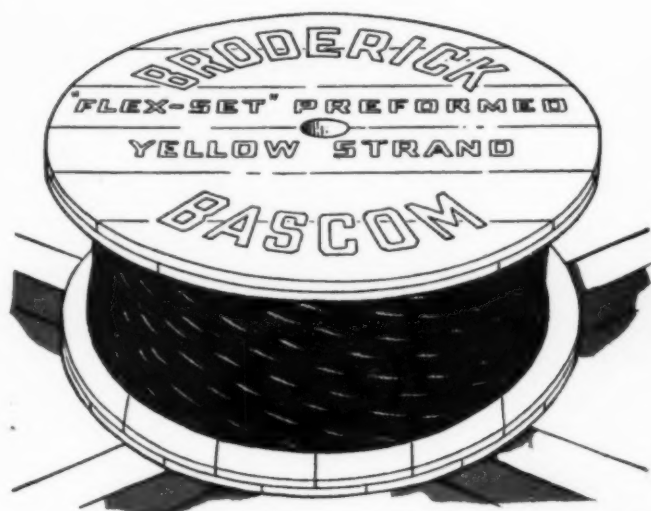
THE WELLMAN ENGINEERING COMPANY
7017 CENTRAL AVENUE CLEVELAND, OHIO

WILLIAMS Buckets
built by WELLMAN

Prompt delivery and service through nation-wide distributors. Write for Free Bulletins on any of the 11 types of Williams Buckets.

SCRAPER PROFITS OFTEN "HANG BY A THREAD"

Cable



GIVE YOUR PAY LOADS THE SUPPORT OF TIME-TESTED YELLOW STRAND

On tightly-figured jobs, profit or loss may hang, thread-like, on the single factor of *cable* performance. That's why it's important to specify, and to be sure you get, "Flex-Set" Preformed Yellow Strand to replace worn ropes on cable controlled machines.

Experience in the field has proved how Yellow Strand helps secure peak production out of today's efficient scrapers. Speedier loading . . . more yardage per unit . . . fewer stops for repairs or cable changes — these are savings you can logically count on because the cable has been specially engineered for service on your equipment.

Every foot of time-tested Yellow Strand has been expertly balanced to combine elasticity, toughness, strength. Starting with highest quality steel wire, drawn to our rigid specifications, it is fabricated by up-to-date mechanized methods that climax 65 years of *exclusive* wire rope manufacturing. Both the wire rope center and the cable itself are *preformed* to make a limber, smooth-running line that is non-kinking, safe to handle and highly resistant to fatigue.

When you order cable — when you *reorder* it — don't run the risk of disappointment. Stick to the rope with the yellow strand. It's ready and waiting for you now at your nearby distributor's store.

BRODERICK & BASCOM ROPE CO., ST. LOUIS

Branches: New York • Chicago • Houston • Portland • Seattle

Factories: St. Louis • Seattle • Peoria

Distributors in All Industrial Centers



"ONE AND ONLY"

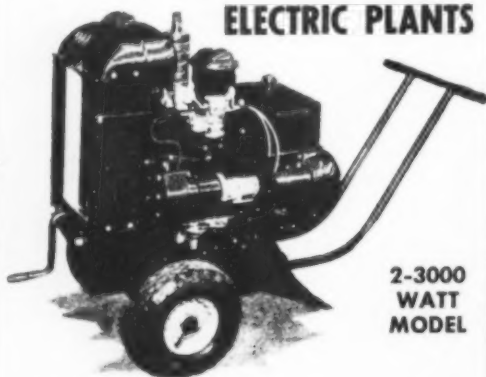
Cost-wise contractors and operators have positive ideas about scraper cable. That so many demand Yellow Strand as their "one and only" rope proves there's no substitute for the demonstrated economy of this veteran road worker.

Next time install long-lived Yellow Strand as specially designed in size, length and construction for your machines. You can't find a better team mate for

**ALL-PURPOSE SCRAPERS
'DOZERS • RIPPERS • CRANES
And All Other Cable Controlled
Equipment**

Replace WORN CABLE WITH
"FLEX-SET" PREFORMED YELLOW STRAND

ONAN Portable ELECTRIC PLANTS



2-3000
WATT
MODEL

SPEED and MORE SPEED is required in present day construction methods. With the increase in Construction due to the present NATIONAL DEFENSE PROGRAM, manufacturing Plants must be completed in the shortest possible time. You can speed up your jobs and at the same time increase your profits with the addition of an ONAN ELECTRIC PLANT to your equipment.

ONAN ELECTRIC PLANTS will supply you with AMPLE ELECTRIC POWER where and when you need it. Operate all Portable Tools on the Job—Drills, Saws, Sanders, Grinders, Tampers, Water Pumps, and will furnish plenty of Light for those Night Jobs.

They're DEPENDABLE too, STURDILY BUILT and "Able to Take it" on the Toughest Jobs. Hand Portable Models from 350 through 1250 Watts—Dolly or Trailers Models from 350 through 5,000 Watts—Stationary Units through 50,000 Watts. Any Voltage—Any Frequency—Air or Water Cooled—Gasoline, Natural Gas, Oil or Diesel Powered Engines.

ONAN ELECTRIC PLANTS are built entirely by D. W. Onan & Sons, and there are THOUSANDS IN DAILY USE IN ALL PARTS OF THE WORLD in every conceivable type of service. We've been manufacturing Electric Plants for over 15 years and most of the original ones are still in use.

Shipped to you COMPLETE and READY TO GO TO WORK.

Your name on a card will bring Complete Details.

D. W. ONAN & SONS

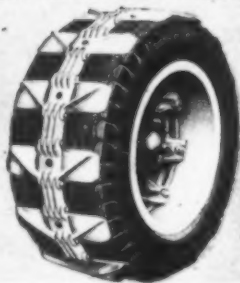
719 ROYALSTON AVENUE • MINNEAPOLIS, MINN.

Where Going is TOUGH

**WARCO J & S TRACTION
TREADS WILL PLOW THROUGH**



In ice, snow, sand, loose ground or mud, your trucks will come through with a pay load if equipped with J & S Traction Treads.



Shoes bridge space between dual tires, forming a large bearing area in contact with ground, producing positive traction, limited only by the power of your engine.

W. A. RIDDELL CORPORATION
BUCYRUS, OHIO

MOISTURE DETECTOR measures moisture content of plaster walls and indicates whether or not sufficient moisture is present to affect paint, wall paper, acoustic tile or other materials applied to it with adhesives. Accomplishes this by calculating electrical resistance of plaster on sensitive meter



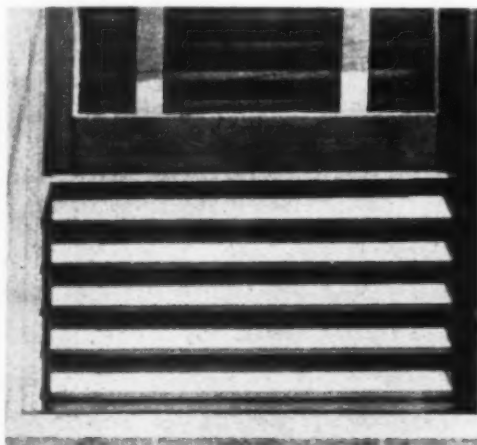
which has been calibrated to indicate when moisture reaches danger point. Also useful in tracing leaks in masonry material, in expediting drying of plaster and for testing brick or concrete for paint application.—Colloid Equipment Co., Inc., 50 Church St., New York City.

★ ★ ★

PHOTO-SENSITIZED ALUMINUM BASE SHEET METAL is recommended by its makers for use in producing permanent to-scale copies of drawings, photographic plates, instruction sheets and special name plates. Templates also may be made of this sheeting. Said to stand rough usage in field without danger of tearing or obliteration of printing thereon. Copies on this metal are made by usual contact printing method or with enlarger from ordinary drawing, regular print or negative. Development and fixation processes same as used with ordinary film. Usual distortion due to unequal expansion or contraction usually, present in sensitized film, paper or tracing cloth said to be eliminated. Furnished in following sizes: 8x7 in.; 8 1/2 x 11 in.; 11x17 in., and 22x34 in.; in thicknesses of .006, .008 and .010.—Republic Engineering Products, Inc., 480 Lexington Ave., New York City.

★ ★ ★

NEW TYPE OF WINDOW VENTILATOR, called "Wind-O-Guard," is said not only to allow proper ventilation, but to assure privacy, control of sunlight, protection against sudden rains and other unfavorable conditions. Widths are in three sizes to fit window openings, 14 to 22 in., 22 to 34 in., and 34 to 54 in. Unit fits securely in window frame



and can be moved readily without interference with screens. Frame and patented louvers are made of Armco Zincgrip sheets with Paintgrip finish. Bronze fittings are standard. Wind-O-Guard comes in natural ivory, baked enamel finish to harmonize with venetian blinds and woodwork.—Wind-O-Guards, Inc., Dearborn, Mich.



A section of the General Motors Research Laboratory, Detroit, Michigan
Architect—Albert Kahn, Inc., Detroit, Michigan
Contractor—O. W. Burke Co., Detroit, Michigan

SPEED and SAVINGS A CERTAINTY

when

HAUSMAN SETS THE FORMS

Freedom from delays . . . close cooperation with the contractor . . . savings on your form setting are three important reasons for Hausman being called on jobs by an increasing number of contractors.

Experienced, skilled workmen on the job not only insure proper and speedy form setting but guarantees meeting your concrete pouring schedules as the job progresses.

Further . . . the versatility of the Hausman method of operation enables you to make savings . . . you can place the entire responsibility for setting forms or any part of the form setting up to Hausman and know in advance from their guaranteed cost just how to bid.

Hundreds of completed jobs have proved the economy of Hausman service. Try it and convince yourself on your next contract.



FORMS FOR OTHER PURPOSES

Hausman also builds ribbed slab forms, removable steel forms for all types of construction where steel forms are economical and adjustable round column molds for multi-story buildings.

The
HAUSMAN STEEL
Company
TOLEDO • OHIO

STANDARD OIL AUTOMOTIVE ENGINEERS...

**SOLVE MANY PROBLEMS
ON ALL TYPES OF FLEETS...**



HEAVY TRUCKING

Power to take the hills and fewer breakdowns on the road are two truck operators' problems on which Standard Oil Engineers concentrate.

These engineers, with their testing equipment, can quickly uncover any mechanical weaknesses in fleet engines that sap power or threaten breakdowns. These engineers, working with your maintenance men, can help them anticipate trouble and take steps to prevent it.

One of these engineers will be glad to show you just how he works.

TAXI SERVICE

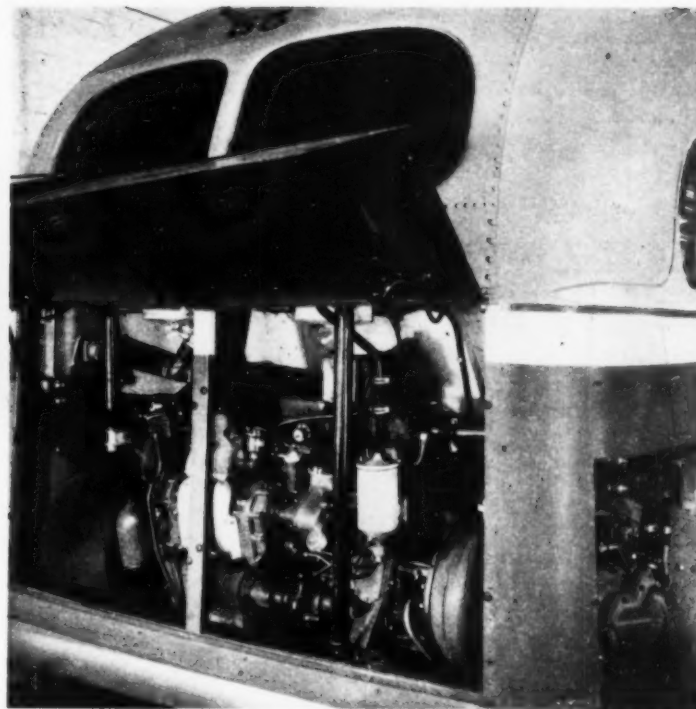
Gasoline mileage and engine maintenance are two of the most important items in taxi operation. The Automotive Engineer's instruments and experience enable him to determine the proper adjustments for the greatest economy under your particular operating conditions.

An average saving of one mile per gallon was made for the Oshkosh, Wis., City Cab Co. fleet shown below, when a Standard Oil Engineer got together with the maintenance men.

Cour. 1941, Standard Oil Co. (Ind.)



STANDARD OIL COMPANY (INDIANA)



BUS OPERATION

In addition to meeting all of the usual operating problems in gasoline-powered fleets, many a bus man finds his life now further complicated by the addition of Diesel equipment. Standard Oil has anticipated the growing use of low-cost Diesel Power for buses. Engineers have been trained to help your maintenance men on any Diesel fuel or lubricating problem.

The fuels and lubricants necessary for Diesel operation are readily available to bus operators. You may find Standard Oil Engineering Service especially valuable now.

CONSTRUCTION

In a fleet of tractors, shovels, draglines and trucks, where gasoline mileage records are not obtainable, it is difficult to tell how efficient the various units are. Standard Oil Automotive Engineers can tell. And they can also determine why any unit is inefficient and what to do about it. This service has saved both gasoline and maintenance money for contractors and county and state highway fleets.

You can reach an Automotive Engineer through any local Standard Oil (Indiana) office, or by writing 910 South Michigan Avenue, Chicago, Ill. In Nebraska, write Standard Oil Co. of Nebraska at Omaha.



HEAT TREATED

Plain Back Shovels

All of our Plain Back Shovels are now heat treated, and every shovel so heat treated has the necessary hardness and proper ductility to insure longer wear.



"AMES" BRANDS
AMES • RED EDGE
TWO STAR • THREE STAR
PINNACLE • MONONGAH
MASSACHUSETTS
KNOXALL

"AMES" PRODUCTS
SHOVELS, SPADES, SCOOPS
FORKS, HOES, RAKES
POST HOLE DIGGERS
AGRICULTURAL HANDLES

AMES BALDWIN WYOMING CO.
PARKERSBURG, W. VA. NORTH EASTON, MASS.

GENERATE YOUR OWN ELECTRICITY FOR CONSTRUCTION JOBS

You can combine convenience and low cost with these independent electric plants. Use them to supply current for hand electric tools, for lighting — for all kinds of equipment. And use them hard . . . these Universals can take it! And they'll deliver reliable current, frequently at less than high line rates.

Any Current from 250 to 25,000 Watts, AC or DC

Universal builds all sizes and types of portable and stationary plants, operating on various kinds of fuel. They are available with manual or electric starting, or full automatic control. It's the industry's most complete line. And behind every Universal is more than 40 years of experience in building plants recognized everywhere for their high efficiency.

Universal "MATCHED UNIT" ELECTRIC PLANTS

Every Universal lighting plant has the proper power, generator, cooling system, etc., perfectly matched to each other to insure the utmost in dependable performance. They are not merely "assembled." Electric generators are built to Universal specifications; all electrical equipment is furnished by accredited manufacturers and guaranteed. That's why many Universals, after more than 25 years of operation, are still in active service.

Write for catalog on the size and type of plant that interests you.

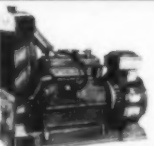
UNIVERSAL MOTOR COMPANY
346 UNIVERSAL DRIVE, OSHKOSH, WISCONSIN



500 Watt Model, equipped with electric start



1000 Watt Model, equipped with electric start



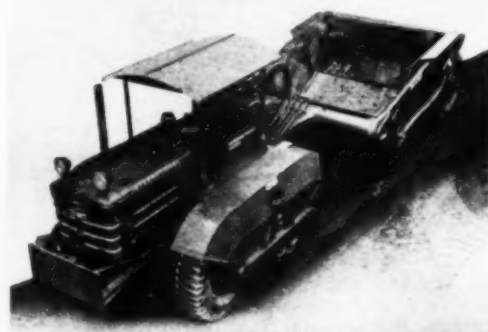
2000 Watt Model, equipped with electric start



NEW MODEL TRAILER-MIXER, available in 10S size, is equipped with V-type air-cooled engine said to give added power and to eliminate excess weight as well as cold weather hazards. Other trailers in this line equipped with air-cooled engines are 5S and 7S models.—**Construction Machinery Co., Waterloo, Iowa.**

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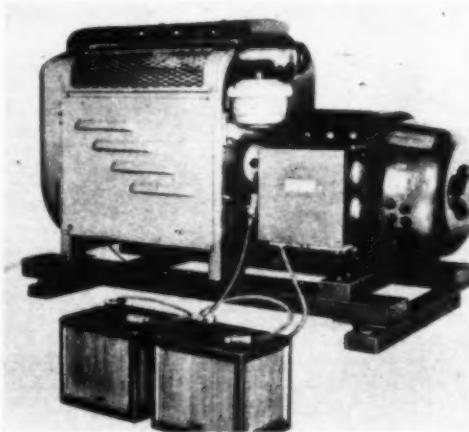
PNEUMATIC TIRED 4-WHEEL DRIVE TRACTOR, called "Wheel-tor" uses standard tractor chassis, power unit and steering system, minus track frame and crawler tracks. Claims following advantages: tractor reliability, service and maneuverability and



increased speed on long hauls. On test runs speeds up to 20 m.p.h. with fully loaded 10-yd. scraper have been attained. Unit pushes as well as pulls and may be operated by workman without long period of training or special skill. Hydraulic operating equipment supplied with unit which is mounted on International TD-14 tractor chassis.—**Isaacson Iron Works, Seattle, Wash.**

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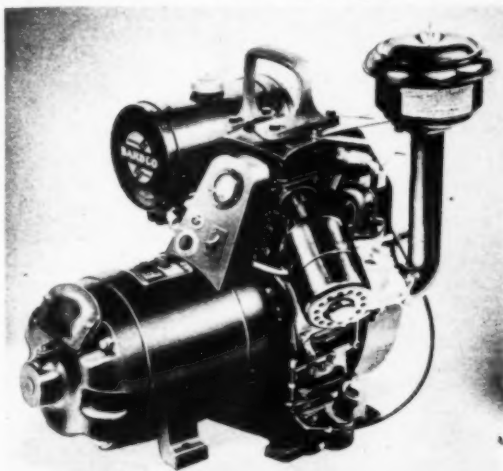
FOUR-CYLINDER LIGHT PLANT, said to be ideal for stand-by service as well as for continuous duty, generates 4,000 watts at 1,800 r.p.m. or 2,000 watts at 1,200 r.p.m. standard 110-v., 60-cycle a.c. Powered by 4-cylinder Le Roi air-cooled engine, 14 hp., bore and stroke 2 3/4 x 3 in. Length, 42 in.; width, 20 in.; height, 29 in. net weight approximately 800 lb. Vibration transfer said to be reduced to minimum



by four-point rubber mountings suitable for stationary, truck or trailer use. Engine furnished with magneto and emergency hand crank. Two 6-v. batteries furnish self-cranking current if self-cranking is necessary. Other sizes in 1,800-r.p.m. units range from 240 to 10,000 watts. 1,200-r.p.m. models available in sizes 1,500 to 7,500 watts. Two or three wire single phase service or three phase available.—**Kato Engineering Co., Mankato, Minn.**

★ ★ ★

LINE OF GENERATING PLANTS has recently been enlarged to include seven air-cooled units and ten water-cooled totally inclosed models, designed to be easily portable and entirely self-contained. Outputs of air-cooled units are 500, 1,000, 1,500 and 2,000 watts at 6, 12, 32 or 110 v. d.c. or 112-220 v. a.c. Features include extreme lightweight, automatic



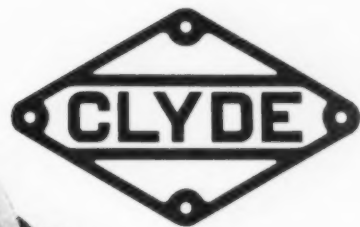
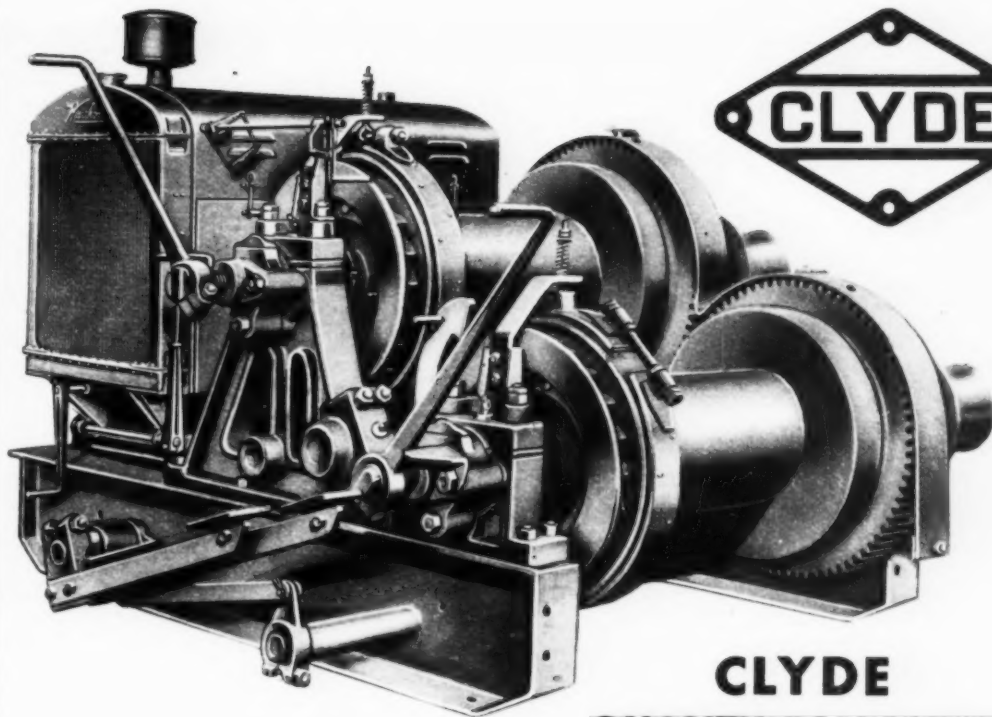
circuit breaker voltmeter or instrument panel, moisture-proof generator windings, air intake cleaner and integral fuel tank. Equipped with electric starter, built-in fuel tank, engine instrument panel containing oil pressure, water temperature and vacuum gages, voltmeter and rheostat and battery ammeter. Available in 3,000- and 5,000-watt sizes, a.c. or d.c. Master generators used on both types of plank are of inherent voltage regulation type. Fully automatic starting and stopping controls optional.—**Bardco Manufacturing & Sales Co., Los Angeles, Calif.**

★ ★ ★

TWO-WHEEL WELDING TRUCK designed to carry oxygen cylinder, acetylene cylinder and complete welding and cutting outfit is said to be lightweight, well balanced and has 14-in. wheels equipped with semi-pneumatic rubber tires. These features are



claimed to make unit easy to maneuver, and to handle over rough places. Overall width has been reduced 4½ in., permitting passage through narrower openings. Size of removable metal tool box for extra blow-pipes, tips, goggles, and wrenches has been increased.—**The Linde Air Products Co., 30 E. 42nd St., New York City.**



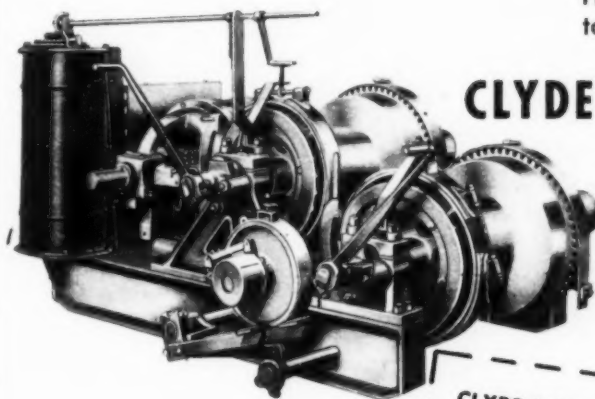
CLYDE QUALITY EQUIPMENT

Gasoline Hoist Sizes			
Single Line Pull, Pounds	Hoisting Duty, Variable Speed, Feet Per Min.	Con. Speed, Feet Per Min.	Motor Horsepower
1,500	110-125	8	8
1,500	160-195	12	12
1,500	185-230	18	18
2,000	150-185	22	22
2,500	160-185	22	22
3,000	185-170	25	25
3,300	180-225	37	37
3,300	200-250	37	37
3,600	180-220	37	37
4,000	160-195	37	37
4,500	145-175	55	55
5,000	200-250	55	55
5,000	160-200	75	75
5,500	200-250	75	75
6,500	180-220	85	85
7,500	200-250	85	85
7,500	160-200	100	100
9,000	200-250	100	100
9,000	180-225	100	100
10,000	160-200	120	120
11,000	180-220	120	120
12,000	150-190	120	120
14,000			

Clyde hoists are scientifically engineered to provide the utmost in efficiency, safety and economy of operation. Every piece that goes into these machines is carefully designed for its particular load and purpose . . . strength is obtained without useless, dead weight . . . economy without sacrificing performance.

Check these Clyde features . . . compare the values.

All steel, electric welded, one-piece beds, extremely rigid. Double cone frictions, smooth, positive and easy acting. One piece drums with barrel, flanges, friction and brake surfaces machined for more efficient operation. Operating levers grouped for convenient manipulation. Semi-steel side stands with wide bearing surfaces. Gears with machine cut teeth, keyed and pressed on shafts. High-grade shafting turned and ground to exact size.



CLYDE IRON WORKS, Inc. Duluth, Minn.

Manufacturers of
HOISTS — DERRICKS — CARPULLERS
WHIRLEYS — HANDPOWERS
BUILDERS TOWERS and
DREDGE ENGINES



CLYDE IRON WORKS, Inc.
Duluth, Minnesota

Please send Bulletin K34 giving complete specifications on Clyde gasoline and electric hoists.

Name

Address

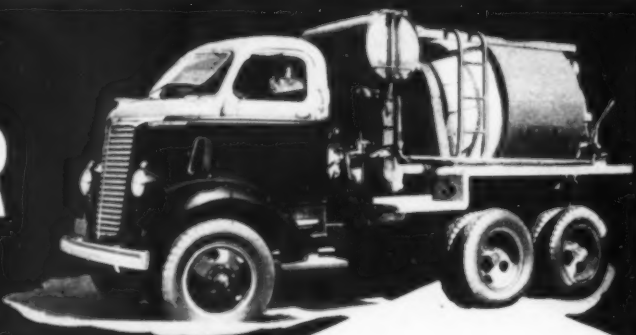
City

State

Special bulletins are available on any line of Clyde equipment.

YOU'LL TAKE PRIDE IN YOUR CLYDE

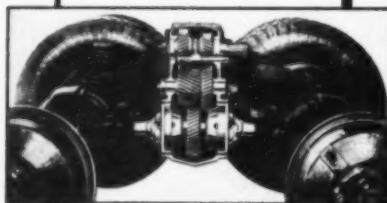
HAUL BIGGER LOADS



GET MORE TRACTION

Two axles under the load are far better than one! **THORNTON Four-Rear-Wheel DRIVE** doubles capacity and tractive effort.

- Cuts investment 25-40%.
- Reduces upkeep 30-50%.



Saves money for operators in scores of industries.

THORNTON TANDDEM CO.
8701-8779 GRINNELL AVE. DETROIT, MICH.

Manufacturers also of the **THORNTON** automatic-locking **DIFFERENTIAL** which gives traction when slippery going makes trucks equipped with ordinary differentials helpless.

"When you need **TRACTION** you need **THORNTON**"

A BARGAIN IN BETTER PAVING for Street Depts., Park Boards, Highway Depts., and a Cost- Cutter for Contractors



Surface can be used right after treatment. Only 10' of street or road are out of use at one time.

the Universal "Chip Top" Spreaderoller

With a road oil distributor and one of these machines you can put down more miles of seal coat pavement of extremely durable quality at amazingly low cost. You can surface or resurface residential streets, park drives, alleys, parking areas and airports with a tough, water repellent, traffic resistant wearing course.

The Spreaderoller segregates the chips or aggregates, depositing the coarse size first, the smaller size next and the fines on top, filling the voids and sealing the surface against bleeding and moisture penetration. Cheaper, less carefully screened chips can be used and dust can be left in.

It rolls them simultaneously, compacting the surface so that it is smooth, firm and anti-skid. After one or two applications of cut-back asphalt, it's once over with the Spreaderoller and you have a long-lasting, glare-less surface at low cost. Traffic can be resumed at once; no annoying detours.

In fifty minutes actual working time, 4,750 lineal feet of roadway 10' wide were paved recently with a Spreaderoller. They got better pavement, got it down faster, with less equipment!

Use the Spreaderoller on existing roads and streets or on new streets where suitable base course has first been put down. Use it, too, as a standard 10-ton roller on other asphaltic pavements. Send for operating data today! Let us show you what the Spreaderoller can save for you.

UNIVERSAL CRUSHER COMPANY, 327 8th Street, West, Cedar Rapids, Iowa

UNIVERSAL

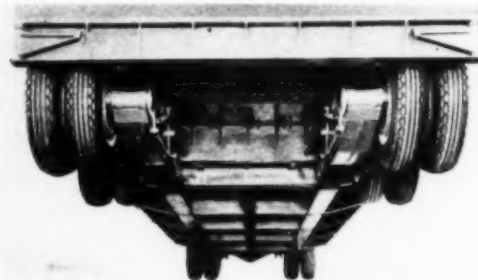
CRUSHERS, PULVERIZERS, COMPLETE PLANTS, SPREADERROLLERS, PORTABLE ASPHALT PLANTS



ZIPPER-TYPE WINTER LINING for Skullgards is so designed and attached to hat that every part of head, neck and ears is covered to provide complete protection against cold and snow. Consists of two parts: (1) Skullcap laced into Skullgard shell integral with sweatband; (2) earflaps that zip into skullcap. This lining may be assembled in field and will not affect original sweatband size. Made of water repellent cloth lined with woolen material. Supplied in two sizes for large and small Skullgard shells. — **Mine Safety Appliance Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.**

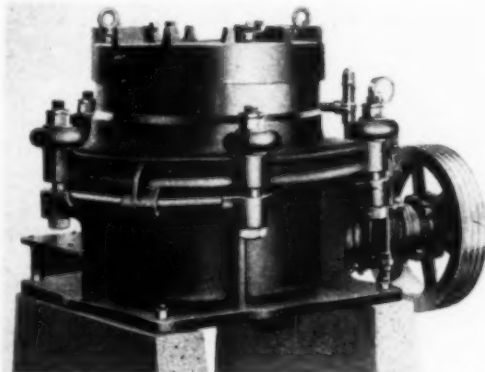
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ROCKING-BEAM TRAILER, said to be innovation in heavy-duty trailer field, has on each side, at rear, welded box section which rocks lengthwise of frame. At either end of each section is short non-tapering axle which carries wheel on two heavy-duty Timken bearings. Axle is cambered to fit



normal crown of road. Said to be popular in states where permissible load is based on number of different axle planes. In these states type T trailers are rated as two axle rear trailers and are acceptable. Design of this trailer also permits building units only 8 ft. wide in capacities from 15 to 35 tons whereas cross-sections of tires restrict standard type trailers of this width to 25 tons.—**Rogers Bros. Corp., 220 Orchard St., Albion, Pa.**

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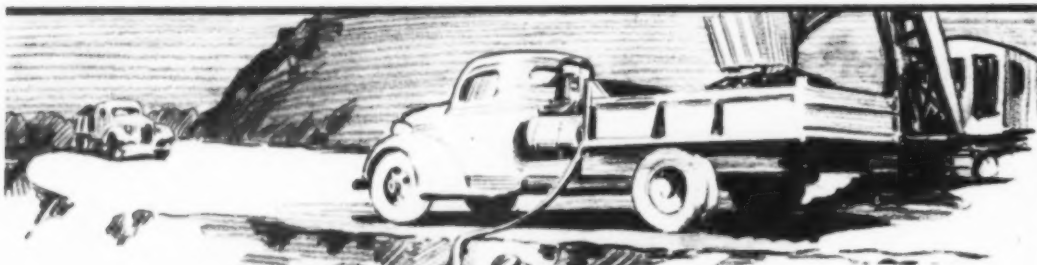
REDUCTION CRUSHER, 28-in. size, an addition to line of Tel-smith Intercone crushers, is offered to large gravel producers who require volume capacity, but who, through necessity, must keep initial investment at minimum.—**Smith Engineering Works, 532 E. Capitol Drive, Milwaukee, Wis.**



If you need a 1-yard excavator with real guts from dipper teeth to cats, ask for the full story on the 29-B.

Bucyrus Erie

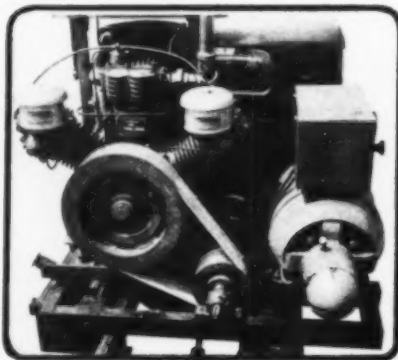
S O U T H M I L W A U K E E , W I S C O N S I N



HERCULES Split-Shaft POWER TAKE-OFFS

**Bring Cost Saving
Equipment to the Job**

On many construction jobs, air compressors and electric welders save both time and costs. The most convenient and economical units are powered by the truck engine, through a Hercules Split Shaft Power Take-off. They are convenient because of their extreme mobility and easy, dependable operation — and economical because upkeep of an auxiliary motor or separate trailer unit is eliminated, and a 7 ft. dump or platform body can be mounted behind the equipment on the truck chassis. Contractors interested in securing full benefit from their power operated truck equipment should investigate the flexibility and economy of Hercules Split Shaft Power Take-off operated equipment.



COMBINATION COMPRESSOR
AND WELDER UNIT

**There's A
Hercules Power Take-off
For Every Purpose**

Direct, side, offset, and dual drive types are available for transmission of the entire horsepower and torque of the truck motor to the auxiliary equipment.

HERCULES STEEL PRODUCTS CO.
GALION, OHIO

Ransome BIG MIXERS and TRUCK MIXERS

at the new

Hercules Powder Plant, Radford, Va.

On the new Hercules Powder Plant at Radford, Va., the Mason & Hanger Co., sub-contractors, used Ransome Big Mixers and Truck Mixers on their end of the job.

Steadily, since long before the turn of the century, Ransome has contributed to the progress made in concrete mixing and handling equipment.

Whether it be road pavers, central mixing plants, truck mixers or portable mixers, Ransome is prepared to assist with equipment that gives the utmost in uninterrupted economical service.

Write for



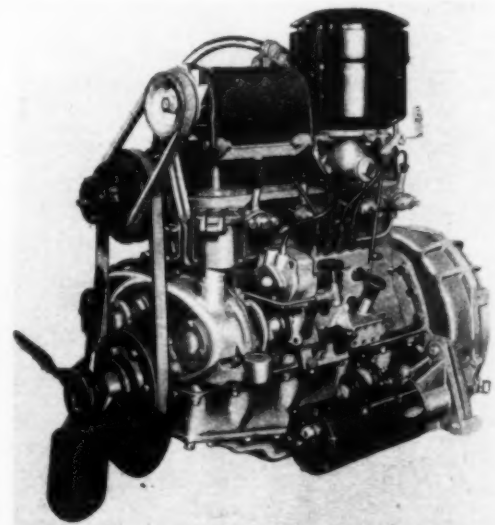
Literature

RANSOME CONCRETE MACHINERY COMPANY
DUNELLEN, NEW JERSEY



Mason and Hanger's central mixing plant with two Ransome 28-S Big Mixers. A Ransome Truck Mixer is shown under the hopper.

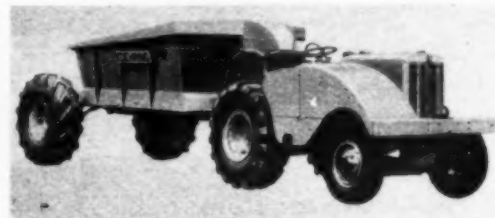
LARGER DIESEL ENGINE in "power package" form for replacement use in Ford trucks is 4-cylinder model with displacement of 255 cu.in., with 4 1/4 x 4 1/2 in. bore and stroke and with horsepower peak of 79



at 2,600 r.p.m. It develops 178 ft./lb. of torque at 1,400 r.p.m. and is said to maintain high torque output over wide range of engine speeds. No major changes in chassis are necessary in making installation.—Hercules Motors Corp., Canton, Ohio.

★ ★ ★

TRAILER DUMP WAGON, 12-cu.yd. capacity, has been added to Koehring line of Trail-Dumps. With increased capacity strength of body has been increased, "automatic hand" winding mechanism has been improved and other changes have been made



to take care of increased load. Powered by General Motors 107-hp., 2-cycle diesel engine or by 107 hp. 6-cylinder gasoline engine, as desired. Develops speeds up to 20 m.p.h. Equipped with below-center, non-raring hitch said to permit 91-in. tractor wheel-base.—Koehring Co., 3025 W. Concordia Ave., Milwaukee, Wis.

★ ★ ★

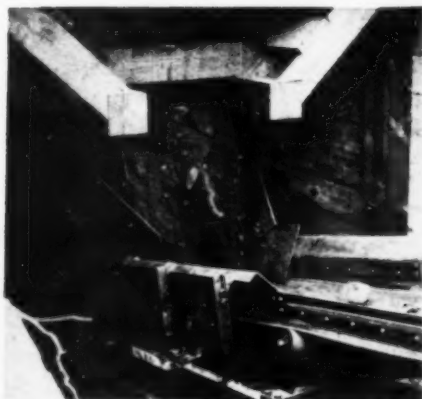
CABLE-CONTROLLED SCRAPER with truck capacity of 15 and heaped capacity of 19 cu.yd. may be used behind standard D8 tractor and loaded either with or without pusher, an advantage that makes unit adaptable either to long or short hauls and to operation singly or in fleet. Blade, 8 ft. 6 in. in width permits use on highways and narrow fills. Double-bucket feature enables first bucket to be loaded to capacity and to travel back on rollers instead of being forced, thus reducing loading resis-



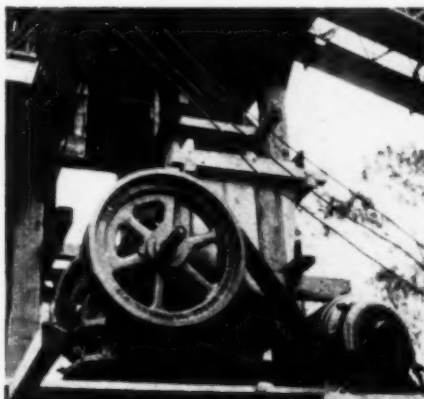
tance and giving larger possible loads for expended tractor effort. High sides retain material that would otherwise "boil" over and be lost by downhill or pusher loading. New apron design increases capacity, reduces overflow and facilitates loading by reducing entrance friction. Positive, wipe-out ejection tailgate gives accurate control of spread, eliminating necessity for secondary spreading tools, emptying bowl completely and quickly. Single dead-ended cable on either side of bowl pulls tailgate from vertical load center, thus reducing friction and wear on tailgate rollers and cable. Goose-neck or swan-neck yoke gives increased clearance for single or dual tires when working on uneven ground.—R. G. Le Tourneau, Inc., Peoria, Ill.

NEW NAVAL AIR BASE

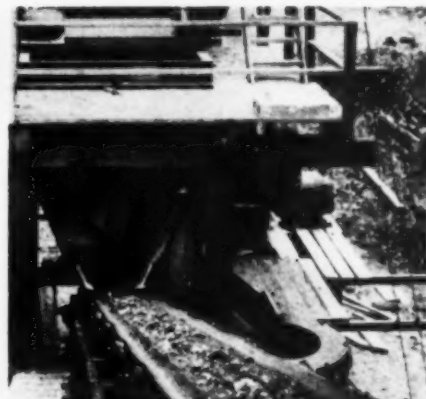
NEEDS 370,000 YDS. SAND AND GRAVEL



Under hopper with rail-bar grizzly, 30' x 5'6" Tel-smith Plate Feeder regulates flow of material onto belt conveyor feeding scalping and crushing plant.



Feed conveyor discharges to Tel-smith Rotary Grizzly and the plus 4" material that it rejects is crushed by 18" x 30" Tel-smith Roller Bearing Jaw Crusher.



Everything passing No. 450 Tel-smith Rotary Grizzly flows over 5' x 10' Tel-smith Single Deck Pulsator. Minus 2 1/2" goes to washing and screening plant...

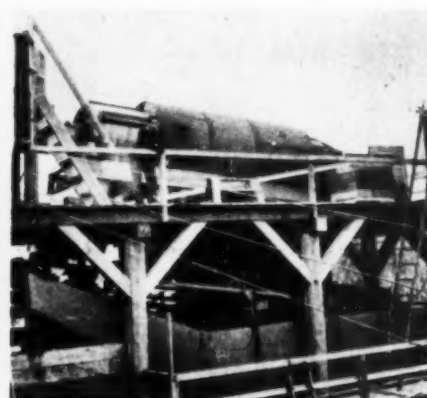
THIS **TELSMITH** PLANT RUNS 20 HOURS A DAY TO SUPPLY IT



... and the oversize from the Tel-smith single deck Pulsator vibrating screen (2 1/4" to 4") goes through a No. 36 Tel-smith Gyrasphere Crusher.



Both crushers discharge onto a return conveyor and, at point of transfer to main conveyor, a 3' x 8' Tel-smith Double Deck Pulsator removes fines.



60' x 18' Tel-smith Standard Washing Screen scrubs and sizes gravel. 48' x 24' and 36' x 20' Tel-smith Sand Drags wash and dewater sand.



The Navy's new 25 million dollar air base at Quonset Point, R. I., will require about 370,000 yards of washed sand and gravel. This aggregate is being furnished by the Boston Sand & Gravel Co. of Cambridge, Mass., with a brand new and completely modern Tel-smith Plant located near East Greenwich, R. I.

Tel-smith engineers, in co-operation with the Boston Company officials, designed the plant especially for this job, and all major equipment

was furnished by Tel-smith. A capacity of 150 T.P.H. was figured but the plant produces as high as 250 T.P.H. Average production is 200 T.P.H. of Navy 1" and 2" aggregate and concrete sand—4000 tons per 20-hour day, with plant operating at times at temperature as low as 16° F.

For dependable advice and quick service coupled with the best in equipment, bring your problem to Tel-smith.

Write for descriptive Bulletin G-10

SMITH ENGINEERING WORKS, 510 E. CAPITOL DRIVE, MILWAUKEE, WISCONSIN

50 Church St.
New York City

211 W. Wacker Drive
Chicago, Ill.

Cable Addresses: Sengworks, Milwaukee—Concrete, London
713 Commercial Trust Bldg.
Philadelphia, Pa.

81 Binney St.
Cambridge, Mass.

Vern Wheeler Eqpt. Co.
Columbus, Ohio

Brandeis M. & S. Co.
Louisville, Ky.

Charleston Trac. & Eqpt. Corp.
Charleston, W. Va.

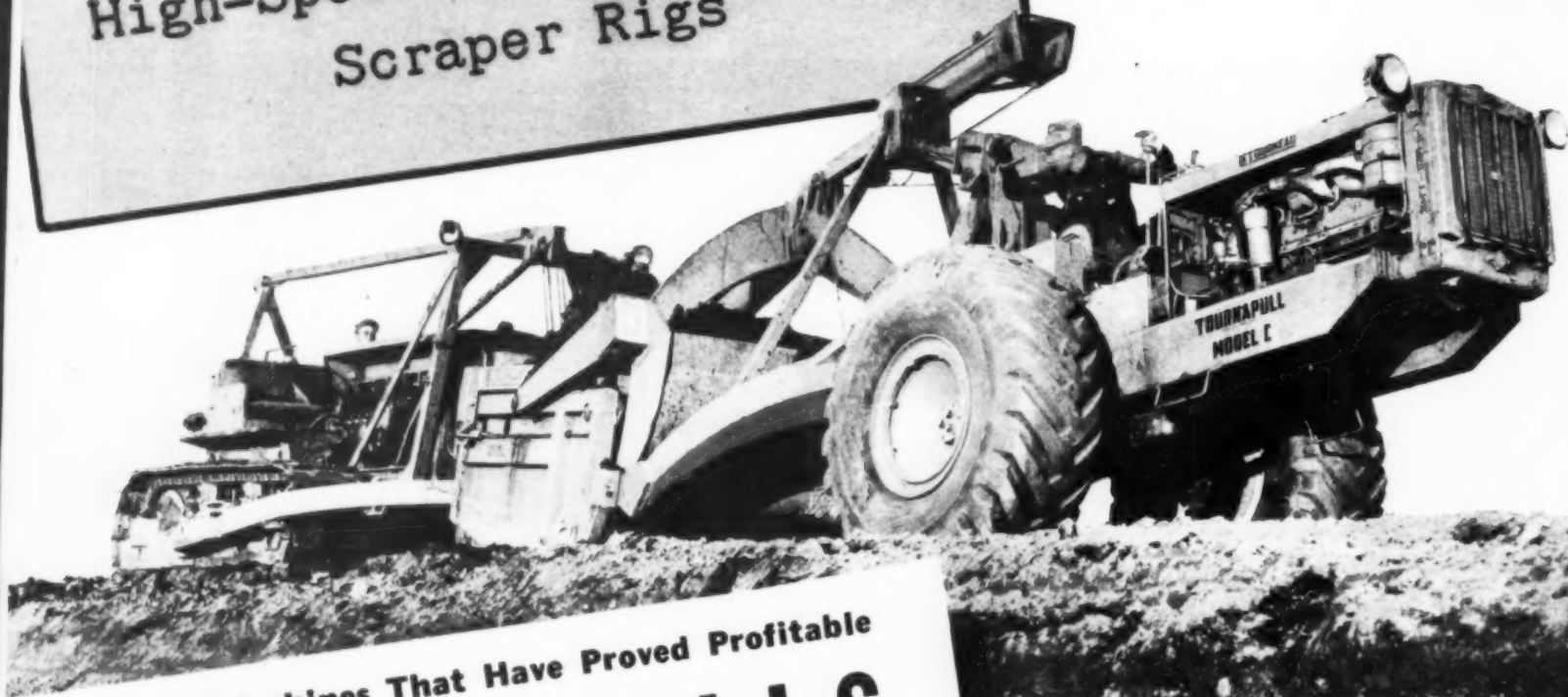
Roanoke Trac. & Eqpt. Co.
Roanoke, Va.

North Carolina Equip. Co.
Raleigh and Stateville, N. C.

Wilson-Weesner-Wilkinson Co.
Knoxville and Nashville, Tenn.

G. F. Seeley & Co.
Toronto, Ont.

To Earthmovers Considering
High-Speed, Self-Propelled
Scraper Rigs



Choose Machines That Have Proved Profitable **TOURNAPULLS**

When you put Tournapulls on your job, you get high-speed, self-propelled rigs designed from the ground up for profitable scraper loading and hauling over construction roads. You get weight where it's needed—on the drive wheels—to give you traction for pulling big yardages through tough going. You get plenty of power and the proper gear ratios with this traction to give you the *quick acceleration* so necessary for *high average speed*. You use the same big-yardage Carryall Scrapers and sure-acting LeTourneau Power Control Units that have proved such big money-makers with tractors. You save on equipment costs, too, because Tournapulls haul and spread their own loads, do a partial job of compacting, require only a pusher for loading.

WORKING IN 30 STATES

Today Tournapulls are in daily use in 30 states and several countries abroad, extending Carryall savings to long hauls beyond tractor-scraper range. Like scores of other successful contractors you can increase your profits with Tournapulls. See your LeTourneau-"Caterpillar" dealer . . . get your order in NOW to assure early delivery.

One of 4 Standard C Tournapulls (powered by "Caterpillar" D468 engines) and LS Carryalls (11 heaped yards) rushing H. E. Wolfe's big airport job at Chamblee, Ga. Other LeTourneau equipment on the project includes 8 Carryalls, 3 'Dozers, 2 Sheep's Foot Rollers and 2 Rooters.

BUILT FOR EASY OPERATION

Just as tiller wheels long ago were discarded as useless on track-type tractors, so LeTourneau eliminated front steering wheels on Tournapulls.



Result: Tournapulls have no front wheels to bog down when traveling or turning in mud or sand . . . can turn faster and sharper than any other self-propelled scraper-hauling rig . . . have a long, easy-riding wheelbase. All operating controls are



within easy reach of the operator's airfoam bucket seat. Big brakes on both Tournapull and Scraper assure quick stopping and complete control on grades.

LE-TOURNEAU

PEORIA, ILLINOIS • STOCKTON, CALIFORNIA

For Lowest Net Cost per Yard - CARRYALL* SCRAPERS, ANGLEDZERS*, BULLDOZERS, ROOTERS*. DRAG SCRAPERS, POWER CONTROL UNITS, CRANES, PUSHDOZERS, SHEEP'S FOOT ROLLERS, TOURNAPULLS* TOURNATRILERS*, TOURNACRANE,

*Name Reg. U. S. Pat. Off.

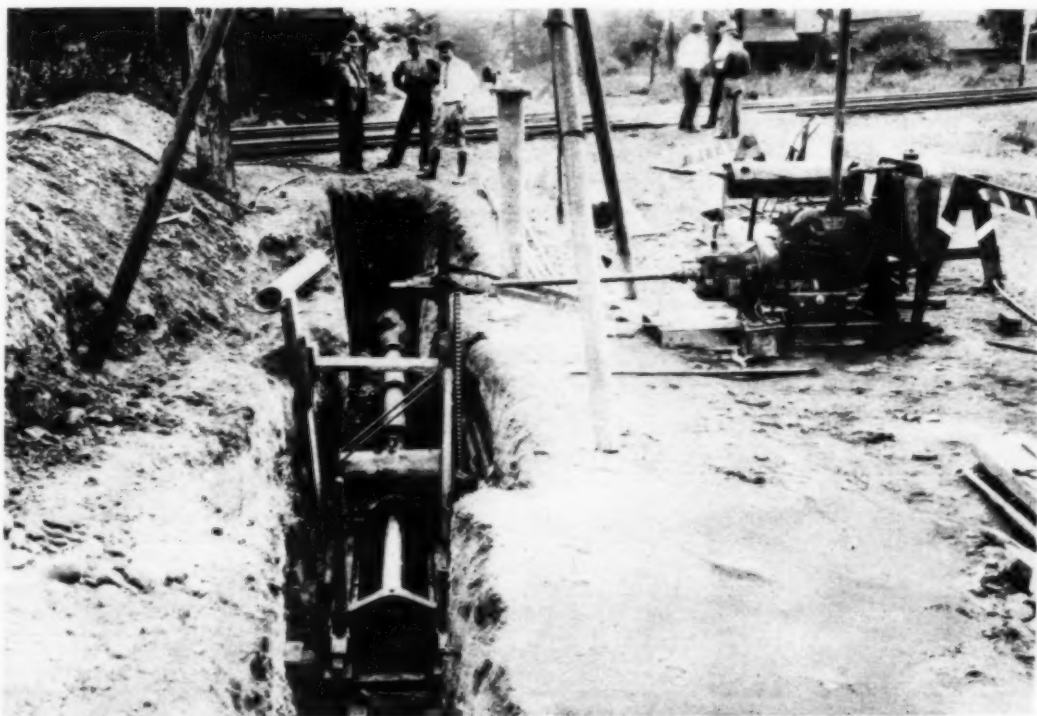




11 1/4-YD. EXCAVATOR featuring vacuum control is now available with complete line of interchangeable boom equipment—shovel, dragline, 18-ton crane, clamshell, backdigger and skimmer scoop. Swing, crowd and retract and travel clutches and crowd brake are vacuum controlled by "vacuum-plus-air" booster type method, known as "closed" system. Standard mechanical linkage from hand lever to clutch is retained and vacuum valve is connected to it. Thus vacuum control provides auxiliary power to assist operator in applying clutch, but does not detract from operator's feel of clutch response and action. Also in event of failure of vacuum system, mechanical linkage automatically is applied without attention from operator, claimed to be safety feature and protection against time losses. Other advantages claimed for this method: (1) cleaner, and self-lubricated mechanism and lines throughout; (2) efficiency of system is not affected by at-

mospheric conditions. Additional features: (1) Revolving turntable (Thew center drive) powered by Caterpillar diesel, gasoline engine or electric motor, as desired; (2) two-speed crawler 12 ft. 9 in. long and 10 ft. 2 in. wide when equipped with 24-in. treads. Speeds: 1 1/2 m.p.h. high; 3/4 m.p.h. low. Steering in either direction at either speed affords maximum maneuverability. (3) All-welded shovel boom 21 ft. long from pin to pin equipped with large 36-in. diameter boom peak sheaves. At 45-deg. boom angle, maximum digging height is 25 ft. 2 in.; digging radius, 30 ft. 10 in. (4) fairlead mounted at front of turntable bed between boom feet, providing direct lead from boom to bucket, through sheave arrangement which keeps drag cable in constant contact with sheaves. Front or vertical sheaves free to swivel and thus maintain direct lead to bucket on side casts and sways.—**The Thew Shovel Co., Lorain, Ohio.**

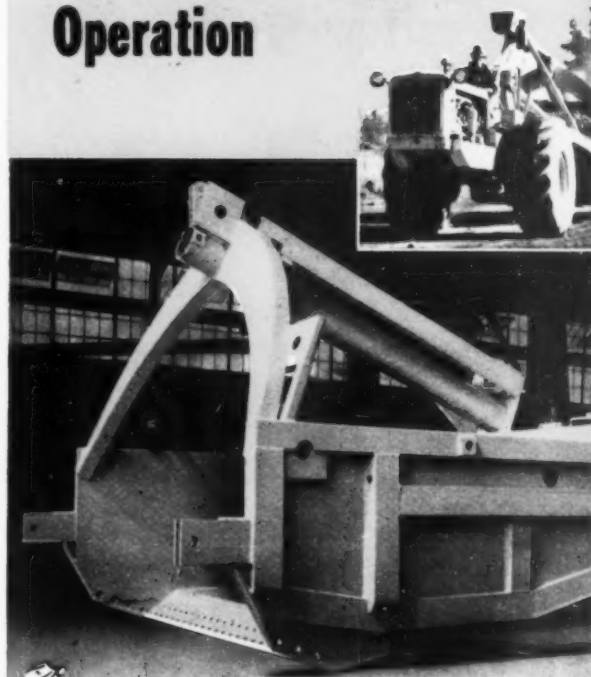
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BORING MACHINE installs casings up to 36 in. in diameter for water lines, gas and oil lines, sewers and conduits under highways and railroads or through embankments. In operation, machine consisting of horizontal rotary drill driven by 20-30-hp. gasoline motor set up on bank, is placed in trench. Casing to be installed is attached to driving head, an 8x13 1/2-in. forged steel flange on forward end of rotating hollow sleeve. Combined rotating and forward thrust of sleeve forces pipe with cutter head into embankment. After sleeve has been advanced to full extent, it is unflanged from casing and returned to starting position. Then an 8 in. by 6-ft.

flanged extension joint is inserted between rear end of pipe and driving sleeve. This operation is repeated until total length of inserted extension joints exceeds that of next joint of casing. All extension joints then are removed, next section of pipe is welded or screwed to preceding one, and cycle of operations is continued. Driving sleeve is hollow to permit removal of earth through pipe. Cuttings are removed, preferably with water, or scoop may be used. Expense and disadvantage of backfilling and settling said to be eliminated.—**The Young Engine Corp., Canton, Ohio.**

HOW to Select a Scraper for High-Speed Operation



GET ONE THAT'S BUILT TO TAKE THE STRAINS AND SHOCKS OF ROUGH WORK... A LeTOURNEAU CARRYALL

A LeTourneau Carryall Scraper body can't warp. It's built like a box, reinforced at every corner, side, top and bottom to prevent twisting and distortion. Bottoms are built of double plate steel with inner channels. Side plates are strengthened with welded channel steel. Front sides are strongly tied together by a high arched frame of steel and a heavy blade base. Rear end of body is made rigid by a heavy box-beam of welded construction. And then, front and rear are joined by the stout springpipe. No other scraper gives you the strength of this Carryall body. More than 8000 in use with tractors. Now, thousands of hours of Tournapull operation... the country over, in mud, sand and heavy going... demonstrate that LeTourneau Carryalls can keep your job moving profitably despite the increased shocks and strains of high-speed work. For profits on long hauls use fast-moving Tournapulls with stoutly-built, cable controlled Carryalls. See your LeTourneau-"Caterpillar" dealer NOW.

Send for Free Book to help you answer your question about self-propelled, high-speed earthmoving units.

Mail to:

**R. G. LeTourneau, Inc.
Department CM
Peoria, Illinois**

Please send me your illustrated booklet "How to Select a Self-Propelled, High-Speed Earthmoving Unit."

Name _____

Position _____

Type of Business _____

Address _____

State _____ City _____

MR X·S·WATER MEETS HIS



POZZOLITH

added to regular portland cement routs Mr. X.S. Water every time. Pozzolith reduces the amount of water needed for placeability by as much as 20%. By this reduction there results concrete of minimum porosity, shrinkage and permeability,—concrete made watertight by direct attack on the big cause of leakage, *excess water in the mix.*

Pozzolith improves all concrete! It greatly increases concrete's workability, ease of placement and strength. Speed-up the job with Pozzolith concrete's greater mobility and high early strengths on rush construction. Speed-up — save time and money.

How Pozzolith Improves All Concrete

Pozzolith contains Master Builders' cement dispersing agent. Cement particles in their normal state in water tend to gather together in bunches; i.e. flocculate. This bunching entraps water within the particle clumps. See microphotograph below.



With Master Builders' dispersing agent these bunches are broken up into individual cement particles distributed throughout the water; i.e. dispersed or deflocculated. See microphotograph below.



This dispersion makes the cement usable to its full efficiency; all the cement surface is made available for hydration and all the water for lubrication of the mix. (Water held within the particle clumps is released.)

As a result of adding a dispersing agent to cement there occurs,—

Greater workability with less water.

Increased strength.

Watertightness.

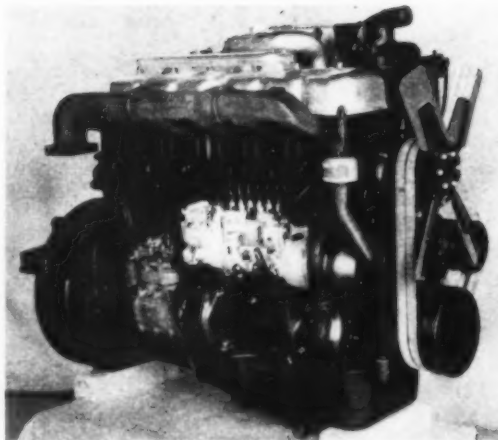
Increased durability (high resistance to freezing and thawing, and corrosion.)

Get the complete story of Cement Dispersion. Ask for Research Paper No. 35.

There are two types of Pozzolith, Standard and High Early. High Early Pozzolith provides all the advantages of Standard Pozzolith—up to 20% water-reduction plus early strengths: normal 3 day strength in 1 day, 7 day strength in 3. Send for the complete story.

THE MASTER BUILDERS COMPANY
Cleveland, Ohio Toronto, Canada

MASTER BUILDERS



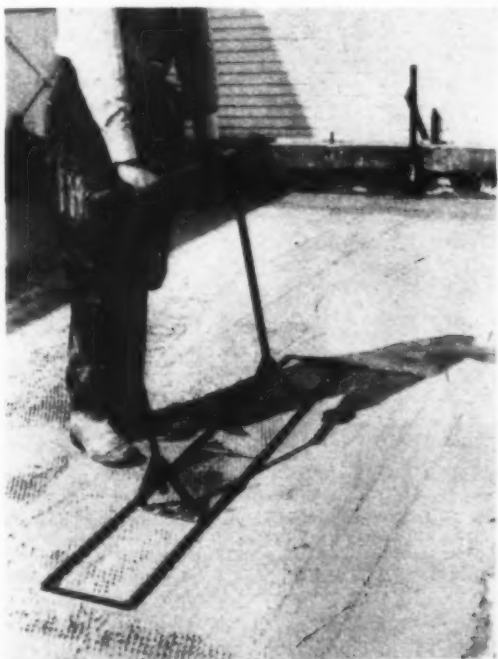
LARGER DIESEL ENGINE. Model END-605, Mack Lanova, has piston displacement of 605 cu.in., bore and stroke of 4½x6 in., operates at maximum speed of 2,000 r.p.m. and develops 144 hp. Maximum torque at 1,100 r.p.m. is 455 lb./ft. Claimed to provide sufficient horsepower to meet heaviest hauling needs and to do the job efficiently and with greatest economy. Important feature: combines smokeless combustion with high power, high speed and smooth running.—Mack Trucks, Inc., 34th St. & 49th Ave., Long Island City, N. Y.

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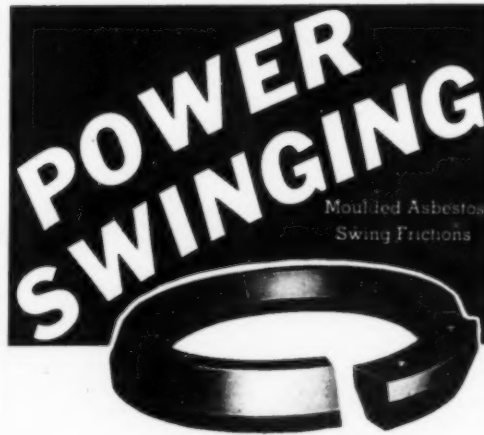
DETACHABLE BITS for rock drilling, designed particularly to hold their gage, have cutting edges where most needed—out at the extreme diameter—and are made of electric furnace steel. Features of bit include broad chopping and reaming edges to insure long runs before changing gage sizes and increased drilling footage between re-grinds. Drill rods to receive bits are of best drill steel threaded with rugged acme thread; rod bottoms in bit, thus transmitting force of blow direct to cutting edges, without requiring threads to absorb shock. Bits are available with standard center holes or with side holes, latter intended for use in formations, such as mud or clay seams, that cause plugging of center holes. Gage sizes of detachable bits range from 1½ to 2¾ in. Rods come in standard lengths from 2 to 30 ft., with 2-ft. changes. For sharpening bits grinders of bench or pedestal mounted types, from 2 to 5 hp. are available.—Sullivan Machinery Co., Michigan City, Ind.

★ ★ ★

HAND GRILL TAMPER is designed for use in preparing concrete floors for final surface finish. Device consists of rectangular framework 5 ft. long covered with steel mesh and fitted with handles



for operation by one man. Tamper's function is to level concrete and knock down heavy aggregates, leaving on top "lat" mix that is suitable for surface finish.—Whiteman Mfg. Co., 3249 Casitas Ave., Los Angeles, Calif.



You'll find the new GATKE HI-POWER Swing Frictions are life savers on TOUGH JOBS.

**TREMENDOUS POWER
SMOOTH ACTION
LONG WEAR LIFE**



They get the job done—save time—keep going.

Whatever your service, we have what it takes to do the job and will guarantee results.

Just tell us what you need.



ASBESTOS PRODUCTS

**FRICIONS - BRAKE LININGS
CLUTCH FACINGS - FABRIC BEARINGS**
GATKE CORPORATION, 226 N. La Salle St., Chicago

FINISHING MACHINES



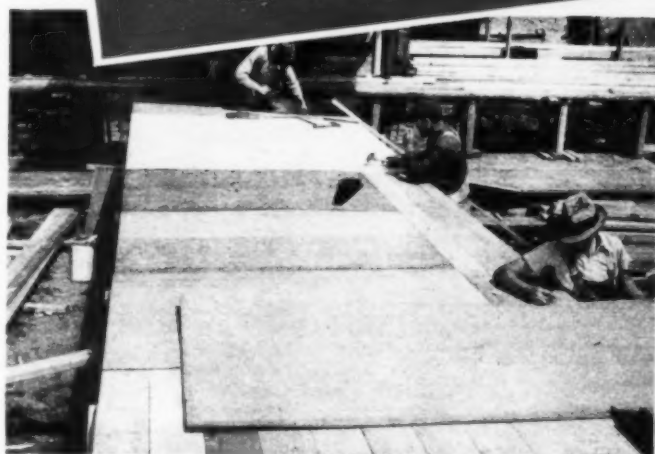
JOINT INSTALLING MACHINES



**FLEXIBLE
ROAD JOINT
MACHINE CO.**
WARREN • OHIO

2 eloquent PLYFORM testimonials

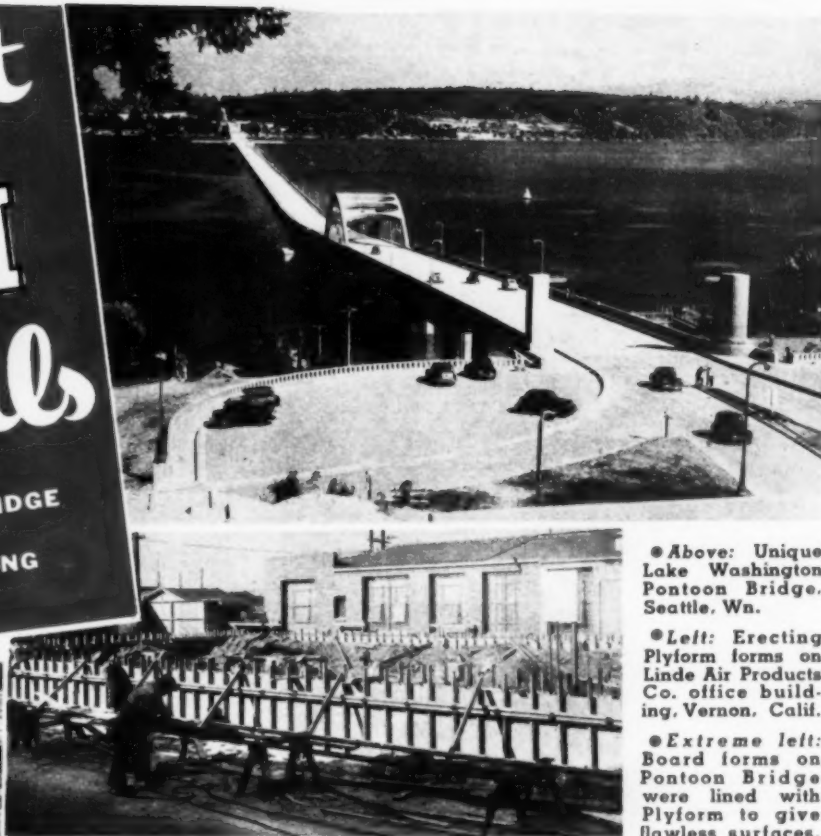
1. LAKE WASHINGTON PONTOON BRIDGE
2. LINDE AIR PRODUCTS CO. BUILDING



● In every part of the country, PLYFORM, the concrete form grade of Douglas Fir Plywood, is giving smooth, flawless concrete surfaces and numerous re-uses. Some of the jobs are large, some small, but on each Plyform saves labor, strips easily, gives 100% coverage without waste, cuts costs of rubbing as much as 12c a square foot.

Plyform is made from special veneer and special highly water resistant glues in strict accordance with U. S. Commercial Standard CS45-40. Each panel is sanded satin-smooth, oil-treated and edge-sealed at the mill. A distinctive Plyform "grade trade-mark" and silver-green edge seal make identification and specification easy.

For free Concrete Form Booklet, write Douglas Fir Plywood Association, Tacoma, Wn.



● Above: Unique Lake Washington Pontoon Bridge. Seattle, Wn.

● Left: Erecting Plyform forms on Linde Air Products Co. office building, Vernon, Calif.

● Extreme left: Board forms on Pontoon Bridge were lined with Plyform to give flawless surfaces.

OXWELD ACETYLENE COMPANY

Unit of Union Carbide and Carbon Corporation

MANUFACTURERS OF
OXY-ACETYLENE APPARATUS FOR
WELDING AND CUTTING METALS

ONE

2315 EAST 52ND STREET
LOS ANGELES, CALIFORNIA

WELDING TORCHES
CUTTING TORCHES
REGULATORS AND ACCESSORIES

September 18, 1940

Mr. Joseph Weston
Douglas Fir Plywood Association
701 Cogswell Road
El Monte, California

Dear Mr. Weston:

The construction of new offices and warehouses for the Linde Air Products Company at Vernon, California has just been completed.

When work was commenced a quantity of Plyform was delivered to the site. This material was first used in the construction of forms for architectural concrete foundation walls. As the building progressed the same material was reused in forms for a reinforced concrete slab at the second floor. Here the lightness of the material made it possible to hang the form from the structural steel, eliminating the necessity of shoring from below. This form proved to be so tight and free from leaks that work was uninterrupted on the floor below even while pouring was in progress. Panels were used a third time in a similar manner at the roof slab.

Although some panels now show wear, especially because they had been used as a working deck for the installation of electrical, heating and other mechanical work, at the second floor and roof, a fourth use of the material was made when forms for warehouse foundations were built. Here entirely satisfactory walls were obtained by selecting perfect panels for the outer or exposed face and using damaged material at the unexposed side.

When the building project was completed a substantial allowance was made by the contractor for the used material which he returned to his yard for further use.

Yours very truly,

OXWELD ACETYLENE COMPANY

By *J. G. Cooke*
J. G. Cooke
Owner's Superintendent

JGC/2b



PROOF OF THE BUCKET



An Owen Type DX Heavy
Duty Round Nosed Bucket.

Dredging generally places abnormal wear on buckets in places not seriously affected by even the toughest above-surface digging.

But Owen designing minimizes such wear with "Alomite" lubricated, sealed underwater bearings and specially shaped counterweights which push the materials away from sheaves and cables.

is in the DREDGING

The OWEN BUCKET Co.

6020 BREAKWATER AVE.

CLEVELAND, OHIO

Branches: New York, Chicago, Philadelphia, Berkeley, Cal.



Utility Tunnel for Eastern Naval Base

on 33

DEFENSE PROJECTS IN THE UNITED STATES

MORETRENCH WELLPOINT SYSTEMS are pumping constantly—keeping excavations dry—helping contractors to complete their work ahead of schedule.

Here's where *immediate* dry results are of vital importance. Here's where almost unanimously contractors are ordering MORETRENCH.

MORETRENCH CORPORATION

Main Office: 90 West Street, New York

Plant: Rockaway, New Jersey

Branch Warehouses: Joliet, Illinois and New Orleans, Louisiana

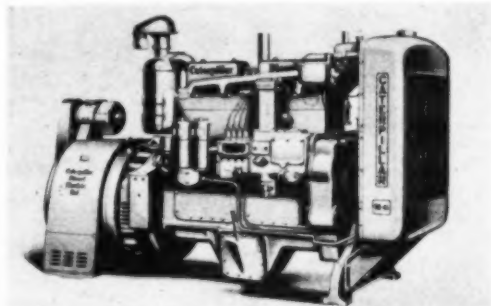
AIR CONTROL POWER SHOVEL, claimed to meet demand for fast, economical, easily operated unit, has all motions controlled by air-operated clutches. Air is supplied by two-cylinder compressor driven from end of engine shaft. Metering-type controlling valves permit operator to apply clutches at desired speed and enable him to spot dipper for truck loading without sudden starts or stops. Unit also provided with air-operated swinging brake which



may be used as traveling brake when machine changes position. Steering accomplished by air cylinders which disengage clutches and engage brake bands. Dipper trip operated by air and controlled by small lever at operator's elbow. Truck parts of cast steel. Tread links of chrome steel, heat treated. Boom of Man-ten steel, box-girder type, all welded. Outside all-welded, Man-ten steel dipper sticks. Independent chain-driven type crowd. High speed shafts mounted on anti-friction bearings; low speed shafts carried in high grade bronze bushings. Single desk heavy-duty swing clutches. Available in diesel, gasoline and electric models.—The Osgood Co., Marion, Ohio.

★ ★ ★

DIESEL ELECTRIC SETS, two new models, are powered by 4-cylinder diesel engines. Model 88-41 has 5 3/4 x 8-in. bore and stroke and develops 41 kw. at 900 r.p.m. when equipped with radiator fan. Without fan kilovolt rating is 44. Model 77-34 has 5 1/4 x 8-in. bore and stroke and develops 34 kw. at 900 r.p.m. with fan, 36 kw. without fan. Both ratings are for polyphase 60-cycle set. Single phase ratings slightly



lower. Sets said to be completely self-controlled requiring no gadgets other than circuit breaker and to be easily installed. Inbuilt regulation enables sets to pick up relatively large motor loads with minimum of light flicker and voltage drop. Designed to be operated by personnel without special training. There are three operating adjustments on engines and none of these involves fuel system. Generators are direct-connected, rotating field type available as 3-phase or single phase, 60 cycles or 50 cycle, and with wide variety of voltages.—Caterpillar Tractor Co., Peoria, Ill.

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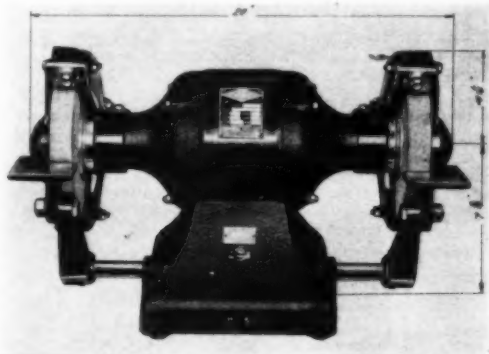
HIGH-SPEED HYDRAULICALLY OPERATED SCRAPER, 8.75 cu.yd. struck, 10 yd. heaped measure capacity, known as "Carrimor" for use with new Caterpillar rubber-tired tractor, is said to load, transport at speeds up to 18 m.p.h. and to spread earth or other material under its own power. May be loaded by dragline or shovel, if desired. Low center of gravity and correct balance said to eliminate bobbing, weaving, twisting and danger of jack-knifing. Also adds to comfort of operator. Scientific bowed design of cutting edge claimed to



make loading easier and faster. Improved guide arrangement said to insure correct operation of rear ejector gate. Honeycomb construction of bowl bottom provides greater strength and rigidity. Independent apron operation permits uniform spreading of any material from sand to gumbo. Special features of hydraulic jacks include chromium plated piston rods to eliminate rusting, pitting and corrosion. Cutting width, 90 in.; overall width, 107½ in.; lift of apron, 44 in.; height of bowl from bottom cutting edge, 57 in.; depth of bowl, 46 in.; clearance when raised, 15½ in. front, 11¾ in. rear; depth of spread, 0 to 15½ in.; overall length of scraper 22 ft. 9½ in.; overall length of tractor-scraper, 32 ft. 10 in.; tire size, 16.00x20 in., 16 ply; approximate weight, 12,250 lb. — **LaPlant-Choate Mfg. Co., Cedar Rapids, Iowa.**

★ ★ ★

BENCH GRINDERS built for all-around service in grinding, buffing and wire wheel work, are available in three sizes: 6-in. light-duty, 6-in. heavy-duty, and 7-in. heavy-duty. Completely inclosed motors. Oversize, dust-tight ball bearings requiring only yearly greasing. All sizes provided with adjustable



tool rests and means of attaching safety glass eye shields. Extra heavy wheel guards. Light-duty and 6-in. heavy-duty machines are of split-phase start, induction-run type and 7-in. heavy-duty unit is of capacitor-start, capacitor-run type with oil-filled condenser in base. Latter, having no centrifugal starting switch, commutator or brushes is said to be best adapted to heavy-duty service and to withstand adverse conditions without burning out. — **Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.**

★ ★ ★

½-IN. ELECTRIC DRILL is recommended by its makers to contractors because of its light weight and compactness and also because of its 100 per cent anti-friction bearing construction. Weighs 8 lb., is 11½ in. long and 9¼ in. high. Die-cast body.



Every moving shaft mounted on friction-free ball or needle-roller bearings. Helical cut gears. Two-pole safety switch has 100 per cent overload capacity. Powered by Universal motor which has no-load speed of 450 r.p.m. and full-load speed of 300 r.p.m. Drilling capacity in steel is ½ in. and in hardwood 1¼ in. — **Skilaw, Inc., 5045 Ellston Ave., Chicago, Ill.**

"I'M JUST ONE OF MANY BLACKHAWK WRENCH SETS for Construction Men!"



NEW No. 52W TRACTOR
AND CONSTRUCTION
SET in radiant-red,
chromium-trimmed portable chest.

Whether it's a whopper 3-1/2" nut on a big construction job — or a midget 3/16" size on the ignition system of your equipment — *there's a Blackhawk Socket Wrench for you!* And Blackhawk Socket Wrenches have more than just ordinary utility. For instance, this new 52W Tractor and Construction Set has a new sparkling line-up of wrenches that save 42% of your investment in similar sizes. Yet they out-wear other high-grade wrenches three to one!

Write for New Wrench Catalog!

48-pages tell the story on Blackhawk's big line of Socket Wrenches, Box-Types, Torque Indicators and Specialty Wrenches. You can buy Blackhawk Wrenches anywhere . . . and we'll send you the names of your Distributors when we mail the catalog.

A Product of
BLACKHAWK MFG. COMPANY
Dept. W2341 Milwaukee, Wis.



BLACKHAWK MFG. CO.
Dept. W2341, Milwaukee, Wis.

Send new catalog featuring Blackhawk Hydraulic Hand Jacks, Gauge-Equipped Jacks, Porto-Power Remotely Controlled Jacks, Pipe Benders and Wrenches.

Name _____

Company _____

Address _____

BLACKHAWK

WORLD'S LARGEST MANUFACTURER OF HYDRAULIC JACKS

Rock Drilling

ON THE SKYLINE DRIVE



SCHRAMM

3 COMPRESSORS

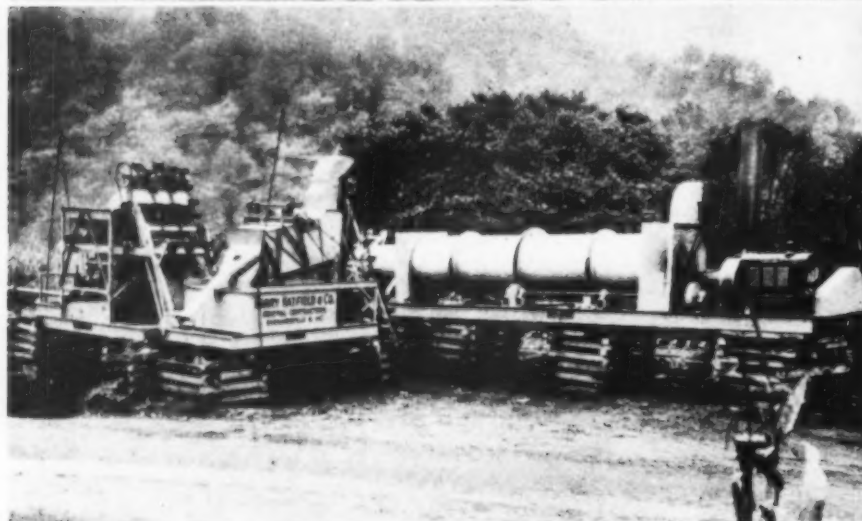
3 DRILL RIGS

Speeded the Work.. Cut the Costs

Powered by International Harvester full Diesel Engines skillfully engineered to operate continuously at full-rated horsepower capacity. Equipped with the SCHRAMM built-in Electric Starter these big... powerful... 315 cu. ft. SCHRAMM Compressors are as easy to start and operate as a modern automobile. Completely water-jacketed cylinders maintain an even temperature for proper lubrication summer or winter.

SCHRAMM, INC. WEST CHESTER, PA.
DEALERS IN PRINCIPAL CITIES

PORTABILITY AND CAPACITY



The new model MH plant—in three units—all wheel mounted and all remaining on the ground during operation. Full size 2500 pound pugmill mixer—dial aggregate scales—fluidometer system—ample drying capacity. Will meet state and federal plant specifications.

STATIONARY
AND
PORTABLE
PLANTS IN
ALL SIZES
•
ENGINEERING
AND
REMODELING
SERVICE
•
WRITE
FOR
DESCRIPTIVE
BULLETINS



HETHERINGTON & BERNER INC.
ENGINEERS AND MANUFACTURERS
701-745 KENTUCKY AVENUE • INDIANAPOLIS, INDIANA



1941 TRUCKS, featuring lighter weight and greater accessibility, have horizontal radiator louvers with radiator shells separate from cores, frames that are tapered only on under side on front and rear and refinements in engine and transfer cases. Cab appointments include an adjustable seat and conveniently located instruments which assure greater driver comfort and greater visibility. Newly designed skirting in front of fenders protects radiator grill and fenders and also acts as bumper. Provision is made for use of engines from 85 to 113 hp. Two



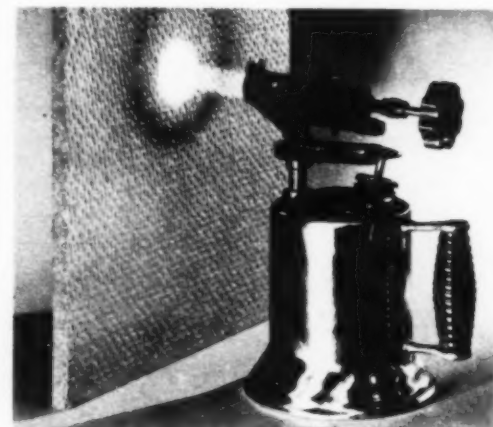
series of axles available to take gross loads up to 20,000 lb. Transfer case so arranged that power takeoff may be installed to utilize all speeds of transmission and full torque of motor for earth boring and similar machines. Fender arrangement accommodates all types of snow plows and front end equipment without alterations to skirting and fenders. Where center scraper plow and under body graders are used, 23-in. clearance under center of truck is provided. Other features: (1) New manufactured axle for "H" series and power proportioning differential for four- and six-wheel drive trucks which divides power in center of truck to each axle in proportion to its normal loaded weight. Of special interest to heavy-duty truck operators is 10-speed transmission. All models furnished in both conventional and cab-over-engine design.—Four Wheel Drive Auto Co., Clintonville, Wis.

★ ★ ★

TWO NEW BALL AND ROLLER BEARING GREASES are now available in wide range of consistencies for all methods of application and operating conditions. One, designated Gulf Anti-Friction grease, is recommended for heavy-duty service; other, Gulf Precision grease, for lighter duty and higher speeds. Both have high melting point and are specially prepared for greater resistance to oxidation and separation. Newly developed method of compounding employing special high pressure kettles and mixing methods said to produce these greases with relatively smooth non-fibrous texture—Gulf Oil Corp., Gulf Bldg., Pittsburgh, Pa.

★ ★ ★

FIRE RETARDANT INSULATING BOARD LATH for use in public buildings of all types, in schools, apartment houses, office buildings, in insulated homes, farmhouses and other buildings with inadequate fire protection, is compounded of felted wood fibers mixed with microscopic flake of expanded vermiculite. These flakes form thousands of fire



walls in each cubic inch of lath, and since they are in intimate contact with wood fibers, they act as fire-stops, preventing spread of flames. In underwriters' tests new lath was used on both sides of wood studding, plastered with gypsum plaster and reinforced with poultry netting. Tests were said to indicate that new board would delay spread of fire from one part of building to other for at least one hour. New lath is available in boards 18 in. wide, 48 in. long and 1/2 in. thick.—Fir-Tex, 1108 Porter Building, Portland, Ore.



Speeding back and forth between Chicago and Peoria—644 miles a day on a mile-a-minute schedule—

Rock Island Rocket #601 now travels 150,000 miles between piston inspections. Before using RPM DELO it was necessary to pull, inspect and clean pistons in the Rocket's 16-cylinder Electro Motive Diesel at one-third this distance—every 50,000 miles!

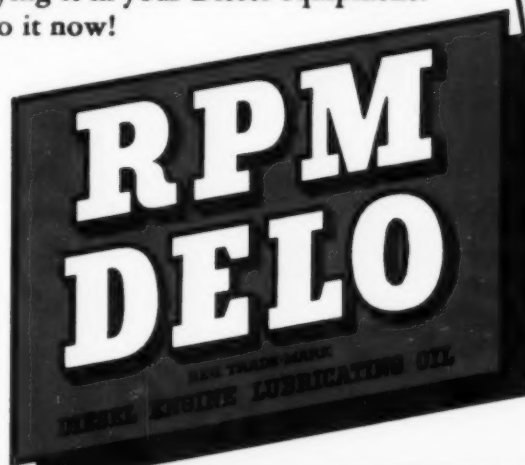
Cylinder wear has hit a record low of .0005" in 160,000 miles!

Piston rings now operate 180,000 miles between replacements—the best ring mileage Rock Island has ever had.

And valves last longer, too! RPM DELO has kept them working perfectly for over 400,000 miles.

Because it keeps engines so clean and lowers wear rate of all engine parts so much—RPM DELO has been chosen by Rock Island for 6 Rockets and most of its Caterpillar, Hamilton and Cummins Diesels used in passenger and switching service.

Aren't these reasons enough for trying it in your Diesel equipment? Do it now!



ORDER RPM DELO
Unequaled
FOR YOUR DIESELS

Approved by the makers of over 95% of the installed Diesel horsepower in America, RPM DELO is marketed under the following names:

RPM DELO
Diol RPM DELO
Kyso RPM DELO
Sohio RPM DELO
Signal RPM DELO
Imperial RPM DELO
Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your locality.

STANDARD OIL COMPANY OF CALIFORNIA

**YOU SAVE
MONEY
by the
MINUTE**

When you use the . . .

**SUPER-VULCAN
OPEN-TYPE
DIFFERENTIAL-ACTING
PILE HAMMER
18C, 30C, 50C and 80C**

The Super-Vulcan gives you twice the blows per minute — therefore, you not only gain in time but drive more piles per dollar. In doing all this your Super-Vulcan uses 25% to 35% less steam per blow.

Be better prepared for those new construction pile driving jobs — do them at less cost—faster — easier.

The Super-Vulcan Open-Type fits same leaders—uses same accessories as Vulcan Single-Acting Pile Hammers and has same widely approved characteristics.

Write today for complete details.



Sizes
18C—30C—50C—80C
meet all needs

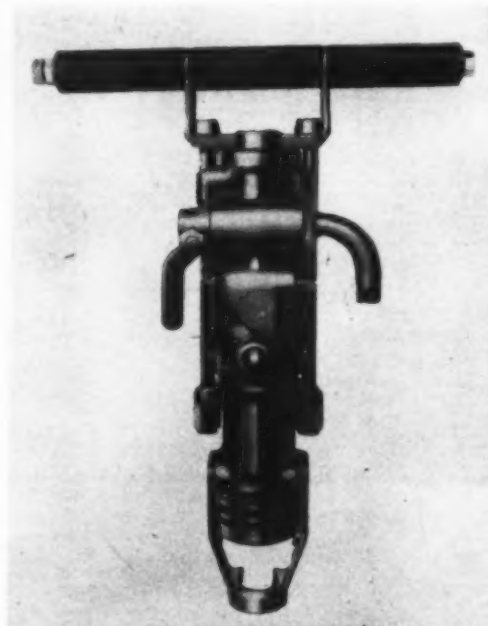
VULCAN IRON WORKS
Since 1892
331 North Bell Avenue

Chicago



Illinois

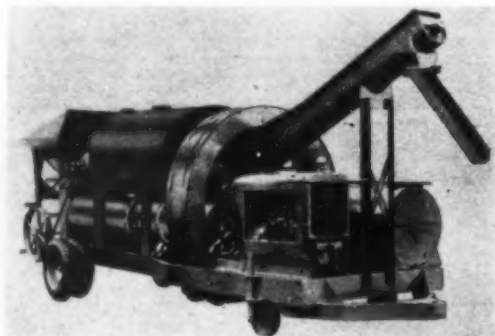
LIGHTWEIGHT SINKING DRILL, claimed to have speed and power usually associated with heavier drills, is of special value in close-quarter operations where excessive weight is a handicap. May



be held in any position for chute blasting, plugging and hitch-cutting. Power and speed said to be due to four-pawl rotation. Pawls are reversible for double wear. To eliminate necessity of pawl plungers are provided special conical springs, wound from flat stock which, unlike wire coil springs, do not wear out within rifle bar. Exhaust control valve, when closed, diverts live air at full line pressure to clean bottom of hole.—Gardner-Denver Co., Quincy, Ill.

★ ★ ★

PORTABLE ASPHALT PLANT, known as "Twin Dryer," makes asphalt paving materials for small contracts, maintenance and patching. Unit consists of two-compartment charging hopper with two built-in-steel plate feeders with adjustments for metering out predetermined amounts of sand and coarser aggregates; twin revolving dryers; oil burning furnaces for dryers; Rotovator to elevate dried aggregates to screw pugmill supply tanks for oil burner fuel and asphalt; blower for circulating heated air from dryers around asphalt tank to heat oil; gasoline power unit; and all drives mounted on steel truck with dual pneumatic tires and trailer hitch. Material is fed from charging hoppers to twin dryers



by mechanical feeders. Adjustments on feeders regulate amount of sand and coarser aggregates. From dryers material passes to Rotovator which elevates it to screw pugmill where hot oil is added. After thorough mixing finished product is discharged into waiting trucks. Self-contained and mounted on pneumatic tires and equipped with retractable trailer hitch, plant may be towed quickly from one project to another by truck or tractor. May be fed directly from gravel plant by conveyor or dragline or backed under two-compartment bin and fed direct. On test run it was said to produce up to 42 tons per hour of mixed asphalt, using 245 gal. of asphalt road oil to 1 ton of aggregate. Specifications on test job called for 30 to 40 per cent gravel 1/4 to 3/4 in. and 60 to 70 per cent sand 1/4 in. minus. In test run 230-gal. fuel tank supplying dryer burners was filled once in 5 days with distillate at 6 1/2 c. a gallon. Over 5-day period 75 gal. of gasoline were used.—Universal Crusher Co., 625 C Ave., N. W., Cedar Rapids, Iowa.

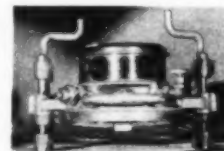


STRONG, STEADY PULLS . . .

. . . or sudden surging impact loads on your wire lines are all measured quickly and accurately with the Martin-Decker Tension Indicator. Without paper calculations or deadending, this instrument tells the exact load in pounds as it falls on the line—catching steady pulls or damaging impacts with equal ease. No wrenches needed—simply clamp it on the line and read the dial!

With this line-load information instantly available, you'll increase efficiency and safety on your jobs . . . reduce wire line replacement costs.

Three Martin-Decker Tension Indicator models cover all line sizes up to 2 1/4" in diameter—all adjustable for temperature changes. Write today for details, and ask also about the Martin-Decker Measuring Line Weight Indicator.

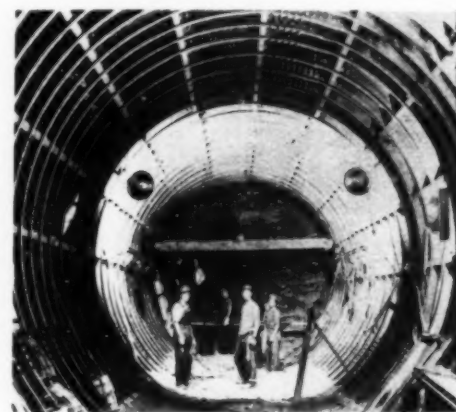


MARTIN DECKER CORP.

LONG BEACH, CALIFORNIA

COMMERCIAL

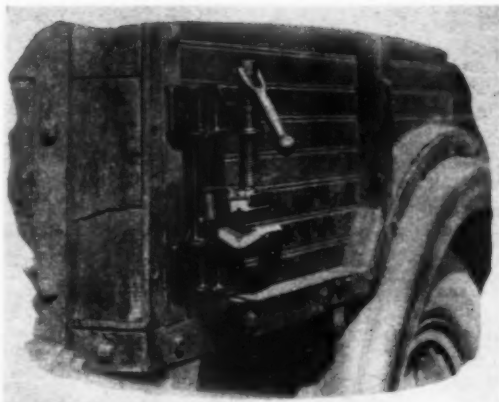
**GIVES YOU EASIER,
FASTER, AND SAFER
CONSTRUCTION ON...**



**. . . DIVERSION TUNNELS BUILT IN
CONNECTION WITH DAM CONSTRUCTION**

The contract for construction of the Kanopolis Dam, on the Smoky Hill River, Kansas, was let in November, 1940 . . . and by January 1st, 1941, the 14 ft., 1/2 mile water diversion tunnel was more than half finished . . . a definite credit to COMMERCIAL Liner Plate efficiency, as they were used throughout. This outstanding COMMERCIAL performance can be duplicated on your next job . . . for any type or size of tunnel, in any kind of ground. Get all the details—write for our bulletins.

**The COMMERCIAL SHEARING &
STAMPING CO.**
YOUNGSTOWN, OHIO



SIDE OPEN PIPE VISE, to be installed on bench or for special purposes on side or rear of service truck, has broad jaws, frictionless disk, quick-acting screw and swinging handle. Accommodates pipe from 1/8 to 2 in.—**Armstrong Mfg. Co., Bridgeport, Conn.**

★ ★ ★

NEW HEAVY-DUTY WELL-POINT for lowering ground water level in construction areas and permitting operations to be carried on in dry, has all-brass jacket designed to reduce clogging in fine soils and pass maximum volume of water without undermining adjacent soil structure. For coarse soils wire mesh screen protected by perforated brass



jacket is said to be most effective, while special tubular slotted jacket is available for work in fine sand. Well-point is sunk by jetting through double orifice in point, controlled by single ball valve. Head is specially cast with cutting edges of hard-alloy metal to dislodge gravel or other obstructions. These well-points are designed for handling sub-surface water in connection with such heavy construction as locks, dams, sewers, docks, buildings and industrial foundations.—**John W. Stang Corp., 2 Broadway, New York, N. Y.**

★ ★ ★



A. C. ARC WELDERS, 500 amp., are said to offer advantages in performance and economy resulting from mechanical improvements and new electrical design which incorporates power-factor correction. This built-in feature claimed to make possible greatly increased power-factor which practically eliminates useless lagging current, permitting employment of smaller primary cable, line switches and fuses, resulting in saving in installation costs, and making possible addition of more welders to existing feeders without causing overload. Any tendency toward unbalanced load is reduced by one-third. Other advantages offered: Finger-tip adjustment by easily

turned current-changing crank; large, easily read current indicator extending up one side of transformer case; protected output terminals accessible through holes in insulating panel; fan-forced ventilation. New welder is less than 4 ft. high, 21 in. in diameter and weighs 600 lb. Only maintenance required is lubrication of fan and current-adjuster every 12 to 18 months.—**The General Electric Co., Schenectady, N. Y.**



DEPENDABLE

Continental Engines on the job

Dependability is the keynote of Continental Red Seal Power. Construction engineers, contractors and builders know this. And when it comes to getting contracts finished on time, they like to work with dependable Continental Red Seal Engines because these smooth, powerful working partners — are always on the job.



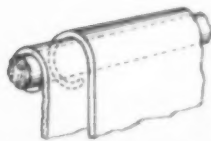
Continental Motors Corporation
MUSKEGON, MICHIGAN

Lightens THE LOAD

FOR concrete work, Sterling Models S-17, S-18 and S-19 are selected by leading Contractors because of these outstanding features:

Perfect Balance 10-Spoke Wheels
Self-Lubricating Bearings
Welded Trays Heavy Tray Load
Malleable Wheel Guards
Channel Steel Legs
Square-Bent Leg Shoes
Hard Maple Handles Interchangeable Parts
Malleable Iron Wheel Brackets

Capacities 3, 3½ and 4 cu. ft. struck.
Complete stocks available from Warehouses and Distributors in principal cities.



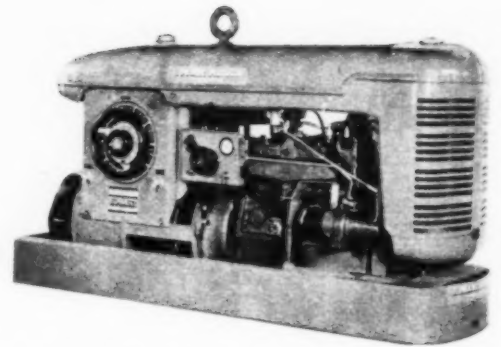
An Exclusive Sterling Feature
Where tray sheets lap, both thicknesses are folded over the continuous butt-welded reinforcing rod, thus giving additional rigidity and strength.

STERLING WHEELBARROW COMPANY
MILWAUKEE, WISCONSIN



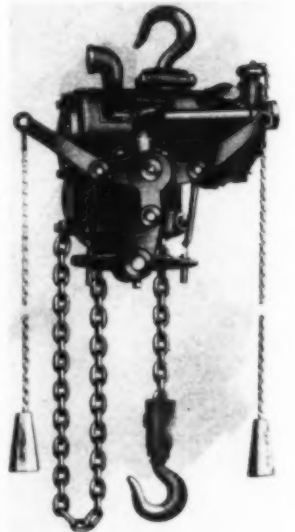
MOST OF THE LOAD IS CARRIED ON THE WHEEL

Sterling Models S-17, S-18 and S-19 are also used for general purpose work, handling sand, gravel, brick, etc. In this service, they have a maximum capacity of 4, 4½ and 5 cubic feet, respectively.



ARC WELDER with built-in power plant is designed primarily for outside work where speedy welding service at job is necessary. Unit has sturdy lifting eye for handling with crane or hoist and may be mounted on emergency repair truck or trailer. Powered by 4-cylinder Hercules gasoline engine with 3¼x4-in. bore and stroke and developing 26 brake horsepower at 1,500 r.p.m., unit provides for all requirements throughout welding range of 40 to 250 amp. Included also as standard equipment are remote control, self-starting push button, ignition lock, polarity switch, variable speed governor, solid-core radiator and top-mounted built-in fuel tank.—**Hobart Brothers Co., Troy, Ohio.**

LINK - CHAIN AIR HOIST for handling all types of light lifting jobs, is available in three sizes, designed to handle loads of 300, 500 and 700 lb. respectively. Air-Bloc, as it is called, weighs less than 75 lb. and is easily portable. Automatic up- and down-stop control prevents damage to hoist from overrun of chain in either direction. Another safety feature said to prevent load from dropping even if air supply fails. Powered by 4-cylinder, radial type air motor which cannot be injured by overloading, according to manufacturer. Throttle control is sensitive, permitting easy and accurate spotting of load.—**Ingersoll-Rand Co., Phillipsburg, N.J.**

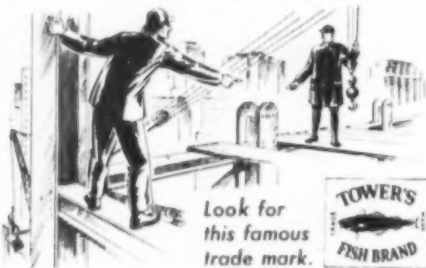


FLEET OF 8-YD. TRUCK MIXERS has been put in service by The Colonial Sand & Stone Co., Inc., of New York City. Unit, mounted on six-wheel truck and powered by 150-hp. diesel engine stands 12 ft. high, is approximately 26 ft. long and weighs 31½ tons, fully loaded. Mixing drum is driven direct from truck engine and by means of vacuum control,



operator starts and stops 16-ton load of revolving drum by flipping valve at steering wheel. Drum equipped with two top charging doors. After enough material to produce 5 cu. yd. of concrete is received through first door, machine moves forward to bring second door under charging hopper where remainder of 8-yd. batch is received. Total capacity of water tank, 325 gal., consisting of mix, flush and tempering water, all of which are controlled from single "Uni-Valve" panel on tank. Special aluminum chamber incloses siphon shut-off in tank so that accuracy of water measurement cannot be affected by splashing or surging of main body of water.—**The Jaeger Machine Co., Columbus, Ohio.**

MEN—get complete all weather protection with TOWER'S RUBBERIZED
(A LATEX PRODUCT)
SUITS, COATS and HATS



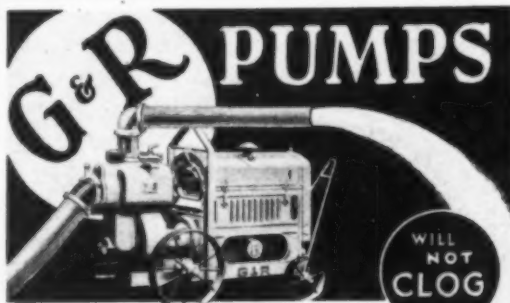
Tower's waterproof, rubberized work clothing gives dependable, durable performance. Medium weight and designed to give the utmost in freedom of movement and comfort. No cemented seams to pull apart. A choice of styles and full line of sizes to fit every requirement. Unaffected by high or low temperatures.

Also available in oiled type garments if desired.

Sold by all good Dealers or write for folder CM to

A. J. TOWER CO.
BOSTON, MASS.

Makers of Waterproof Clothing Since 1836



The Most DEPENDABLE Pump For The Least Money

Claims of fastest priming, highest suction lift, more gallons per minute, etc., do not pump water. On the job, the pump must do its own talking, and with dirty water, many a pump is inclined to stutter—and stop.

Let G & R Pumps tell you their own story on any job. They will deliver as much, and usually more, water under any condition, than any other pump. We will ship you one and let you be the judge.

Remember this about G & R Pumps—**THEY WILL NOT CLOG—THEY ASK NO TIME OUT.** Play safe! That is why more contractors are standardizing on G & R Pumps than on any other make.

Distributors in 100 principal cities are ready to make prompt delivery of the G & R Pumps you need.

THE GORMAN-RUPP CO. Mansfield, Ohio

YOU ARE LOOKING AT A

trouble-free

BULK CEMENT PLANT

Completely Portable . LEAK-PROOF . WEATHER-PROOF
its Mechanically right

Trouble-free because: CEMENT GATES are made of machined castings, will not leak or jam — WEIGHING SCALES are precision type, show when batcher is full or empty — BIN SLOPES are steep and smooth for fast flow of cement — BEST QUALITY CONVEYORS and power drives are used. It's the easiest plant to erect, dismantle and ship.

You get a complete unit. Nothing else to buy and no complicated erection problems.

A Blaw-Knox Bulk Cement Plant is ready to go to work when you get it. It's a self-contained, efficient plant which unloads, elevates, stores, accurately weighs batches, and loads bulk cement into trucks, truck mixers, etc.

Built to keep contractors' jobs running at top speed, Blaw-Knox Bulk Cement Plants pay for themselves in savings. Interesting facts and figures on the economy (as much as \$40 per day) of using bulk cement are yours for the asking.

Shipments can be made immediately, from stock. Send for Blaw-Knox Catalog No. 1566.

BLAW-KNOX DIVISION

OF BLAW-KNOX COMPANY

FARMERS BANK BLDG. PITTSBURGH, PA.

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NO PIT REQUIRED

Elevator rests on ground level

BLAW-KNOX

BINS AND BATCHERS
ROAD FORMS
STREET FORMS
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SPREADER-VIBRATOR
CONCRETE BUCKETS
CLAMSHELL BUCKETS
TRUCK MIXERS

STRIPING MACHINES
TURNABLES
ROAD FINISHERS
STEEL FORMS

"COST REPAID IN 9 DAYS — and better Stabilization!"

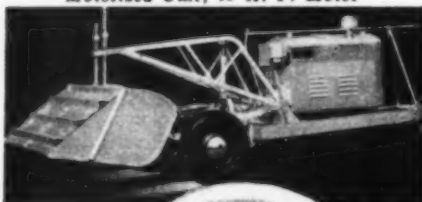
That statement is typical of letters received from highway engineers and contractors who have found the SEAMAN PULVI-MIXER a perfect answer to fast, thorough in-place mixing of road stabilizing materials.

Even when a travel plant is used in mixing, the PULVI-MIXER can profitably be employed to aerate or dry the materials beforehand to speed up the mixing operation.

Applications are numerous. In cut back asphalt, black top, oil mat, sand clay, asphalt emulsion (to name but a few) the tractor driven or the Motorized PULVI-MIXER does the job better and at far less cost.

Top — Oklahoma City. Sand Tar Runway.
Center — Camp Lee Petersburg, Va. Dry Mix Sand, Gravel, Clay.
Bottom — Camp Lee. Note Leveling Effected While Mixing.

Motorized Unit; 90 H. P. Motor



SEAMAN MOTORS
MILWAUKEE WISCONSIN

The SEAMAN PULVI-MIXER

Delaware — Sand-tar Stabilization.



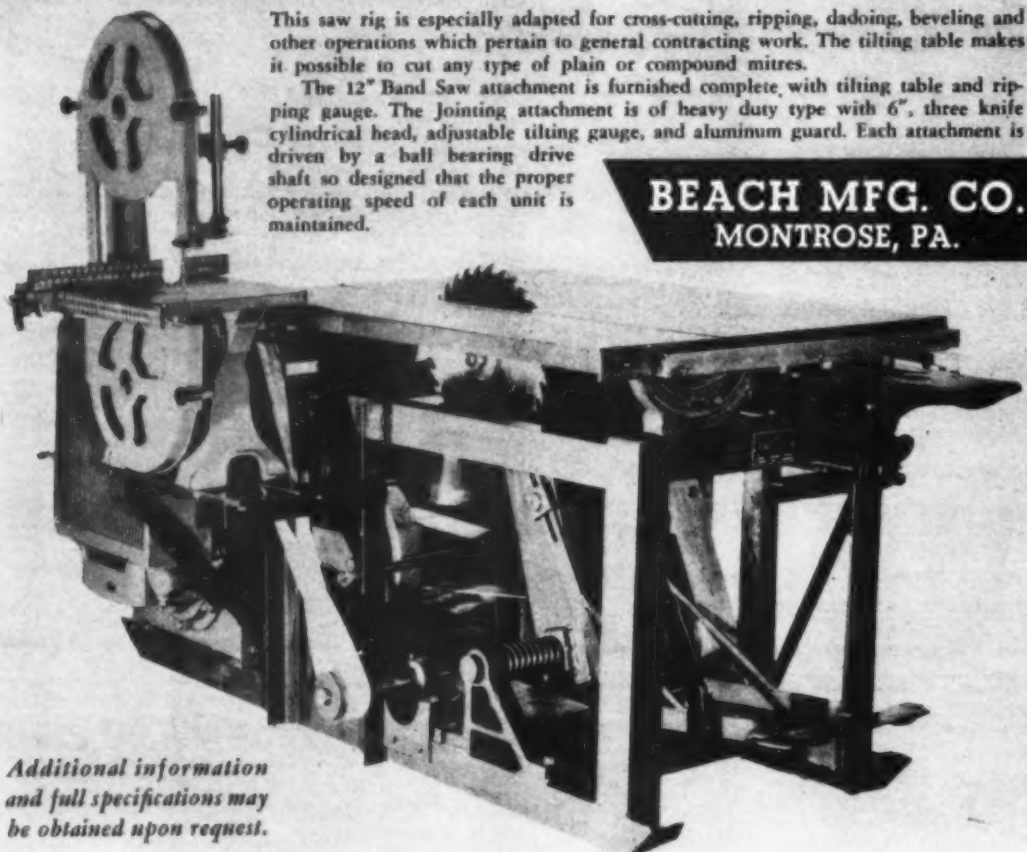
BEACH

No. 10-A TILTING TABLE, PORTABLE SAW RIG WITH BAND SAW AND JOINTING ATTACHMENTS

This saw rig is especially adapted for cross-cutting, ripping, dadoing, beveling and other operations which pertain to general contracting work. The tilting table makes it possible to cut any type of plain or compound mitres.

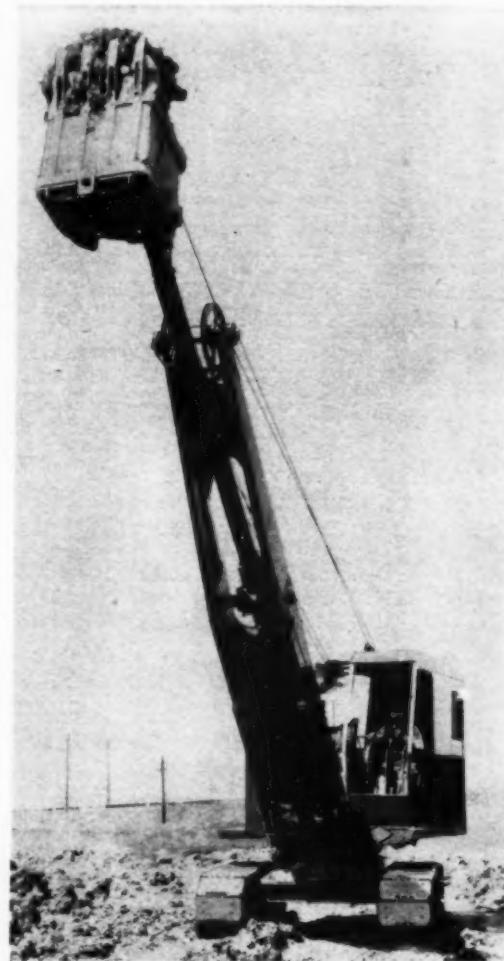
The 12" Band Saw attachment is furnished complete, with tilting table and ripping gauge. The jointing attachment is of heavy duty type with 6", three knife cylindrical head, adjustable tilting gauge, and aluminum guard. Each attachment is driven by a ball bearing drive shaft so designed that the proper operating speed of each unit is maintained.

BEACH MFG. CO.
MONTROSE, PA.



Additional information and full specifications may be obtained upon request.

COMBINATION SHOVEL, DRAGLINE, CRANE AND PULL SHOVEL called Super-Paymaster, is said to work equally well as any one of these units and to allow easy and quick changeovers from one combination to other by changing front-end equipment. When equipped as clamshell or dragline, capacity depends upon length of boom and material to be handled. When equipped as crane it has 13-ton capacity. As shovel it is equipped with 18-ft. boom and 15-ft. dipper handle. New features: (1) Proper balance—machinery and power plant



placed to extreme rear of rotating frame so that greater capacities may be obtained without effecting weight of machine; (2) hook rollers relieve center pintle of all digging shocks; (3) easy to operate; (4) anti-friction bearings at all important bearing points, including drums; (5) machinery supports mounted on one-piece steel cast rotating base with finished bolt; (6) internal expanding type, toggle-operated swing clutches with housings 17 in. in diameter by 6 in. wide; (7) truck of modern welded construction is equipped with lock for locking both crawlers from operator's position. Crawler treads are 22 in. wide, with 30-in. treads optional; (8) independent boom hoist; (9) all-steel, box-type boom electrically welded. Dipper handle single seamless type 7 in. in diameter; (10) cab equipped with winter front; (11) power take-off consists of multiple roller chain operating in bath of oil; (12) chain or cable crowd furnished.—Lima Locomotive Works, Inc., Lima, Ohio.

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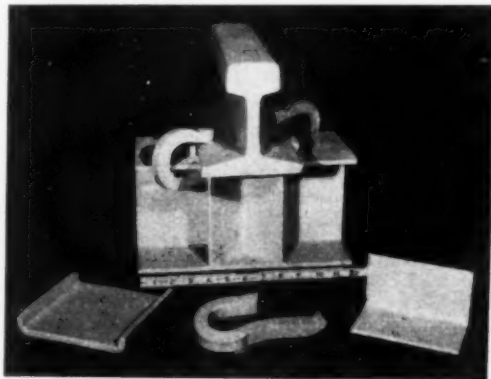
TWO TYPES OF SHEET PACKING, one made of Ameripol, synthetic rubber, and other of Koroseal, synthetic elastic materials are now available to users of this material. Ameripol is dark sheet packing said to be superior to natural rubber in its resistance to action of oils. It ages well and is claimed to provide excellent resistance to heat and cold as well as to water absorption. Tensile strength is approximately 1,500 lb. per square inch; elongation, 400 per cent; shore durometer hardness 78 to 82. Made to order in 100-lb. rolls, approximately 36 in. wide, in thicknesses from 1/32 to 1/4 in. inclusive. Square yard of 1/16-in. size weighs 4 3/4 lb. Koroseal packing especially compounded to resist action of oils and solvents and also resists action of some corrosives. Tensile strength about 2,200 lb. per square inch; elongation, 300 per cent; shore durometer hardness, 73-77. Furnished in 26x26-in. sheets with 1/32-, 1/15-, 1/4- and 3/16-in. sheets carried in stock and other thicknesses made to order.—B. F. Goodrich Co., Akron, Ohio.



SINGLE-DRUM PAVER, 37 4-cu. ft. capacity, is said to average close to 400 batches per 8-hr. day in operation for White Consolidated Inc. In addition to increased capacity, it is claimed that new paver is easy to maneuver and transport. For traveling on trailer superstructure may be lowered by power after pulling out two pins. No water connection or other parts need be disassembled. Construction features include: Double-cone drum, fully inclosed travel gears running in oil, Timken bearings on all high-speed shafts, power takeoff consisting of helical cut gears running in oil and water system unaffected by line pressure or change in grade — **Foote Co., Nunda, N. Y.**

★ ★ ★

H-BEAM STEEL RAILROAD TIE, known as Anchor tie, for use in mine and industrial tracks, has gage fixed by two double-shouldered $\frac{3}{8}$ -in. tie plates $5\frac{1}{2}$ in. wide, arc-welded to 6-in. H-beam 8 ft. long and weighing $15\frac{1}{2}$ lb./ft. Four $3\times\frac{3}{4}$ -in. angles are arc-welded directly beneath tie plates between two



flanges of beam to act as stiffeners and retainers for spring clamp. Combination of beam, tie plate and angles forms stiff pedestal construction at point of maximum load. Spring clamps said to have enough "give" to create resiliency to whole track structure thereby eliminating detrimental effects of rigid pedestal. Rails are fastened to ties by heat-treated spring steel clamps, four for each tie, driven to



place with spike maul or sledge hammer. As hook end reaches base of rail, other end of clamp snaps over corner of angle, hump near end preventing slipping. Clamp is further secured by end engagement of tie, forcing hump against angle. As nose of clamp bears against rail flange, loop produces slight spring action giving added resiliency to track structure. To remove clamp from tie, blow is struck against hump driving it back over corner of angle. Claimed to be easier to install than wood ties and to require less maintenance — **Bethlehem Steel Co., Bethlehem, Pa.**

Wherever you turn
SKILSAW
is on the job for
UNCLE SAM!



in building
FORT ORD
in
CALIFORNIA

...148
SKILSAW
TOOLS

Top speed is the word . . . so builders of the world's biggest defense program turn to **SKILSAW** above all others to speed up every sawing job! That's why Fort Ord is being built with the help of **SKILSAW** . . . that's why so many orders we get call for **SKILSAW** in lots of 30 to 100 . . . that's why more **SKILSAWS** are used by builders than all other makes combined! No other saw can give you **SKILSAW**'S time-saving, cost-cutting, profit-making features. 9 powerful models for wood, metal, stone and compositions.

SPEED CONSTRUCTION AND CUT COSTS



SKILSAW, INC.

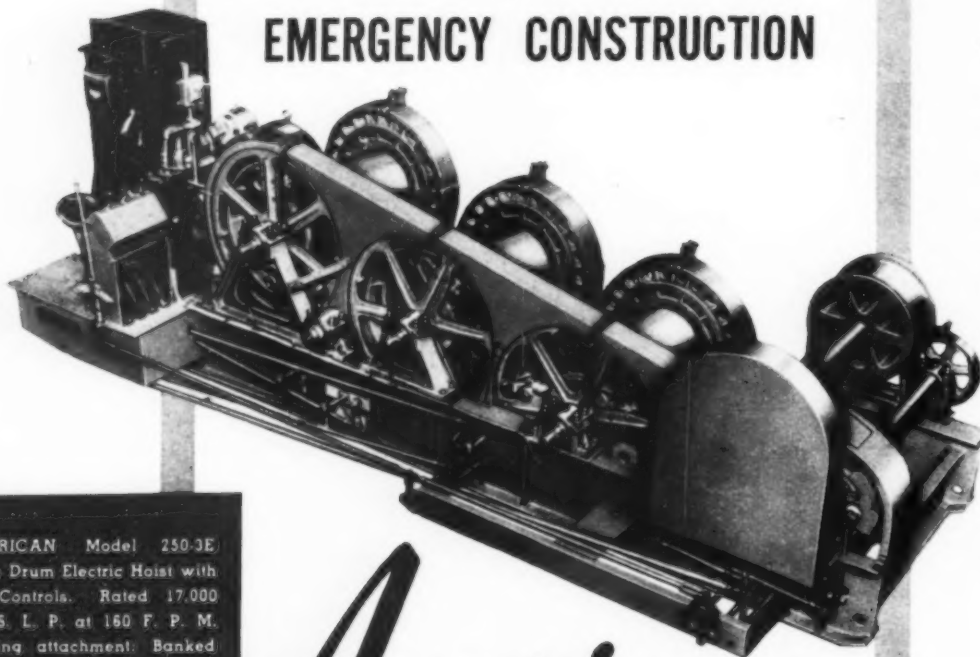
5045 ELSTON AVENUE, CHICAGO

36 East 22nd St., New York—52 Brookline Ave., Boston—182 Main St., Buffalo—15 S. 21st St., Philadelphia—2902 Euclid Ave., Cleveland—2124 Main St., Dallas—918 Union Street, New Orleans—29 North Ave., N. W., Atlanta—2645 Santa Fe Ave., Los Angeles—2065 Webster St., Oakland. Canadian Branch: 85 Deloraine Avenue, Toronto.

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FORD J. TWAITS CO.
and
MORRISON-KNUTSEN
COMPANY, INC.
Joint Contractors



INSURE UNINTERRUPTED PROSECUTION OF EMERGENCY CONSTRUCTION



AMERICAN Model 250-3E
Three Drum Electric Hoist with
Air Controls. Rated 17,000
lbs. S. L. P. at 160 F. P. M.
Slewing attachment. Banked
Levers. Owned by Panama
Canal.

American

AIR CONTROLLED
CONTRACTING BAND
FRICTION HOISTS

Have the necessary Power, Ease and Flexibility of Operation
— and RUGGEDNESS — to give one hundred per cent. service on present day
"High Pressure" jobs. With the AMERICAN Improved Air Control all opera-
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NEWS FROM MANUFACTURERS

About Their Products

The publications reviewed below, will keep you
posted on latest developments in construction
equipment and materials available for your use

GAS AND DIESEL POWER UNITS—**Hercules Motors Corp.**, Canton, Ohio. (76 pp., illustrated.) Wide range of types and sizes of gasoline and diesel heavy-duty power units—4 to 200 hp.—with data on 6-, 4- and 2-cylinder machines, including dimension views, power curves, working load tables and complete specifications. Two pages are devoted to recommendations for proper selection of power unit for work to be accomplished. Units of 4 and 6 cylinders are available in closed, open and base types. Feature of diesel unit design is progressive turbulence and controlled combustion of fuel mixture. One section of catalog deals with such accessories as electric starters, mufflers and silencers, fuel pumps, air cleaners, oil purifiers, spark plug covers and operating speed controls. This catalog is unusually comprehensive, well arranged, profusely illustrated and for quick reference. It tells prospective user about every thing he needs to know in making proper selection of gas or diesel power units within a range of from 4 to 200 hp.



HERCULES
POWER UNITS

★ ★ ★

HOW TO MAINTAIN D. C. MOTORS—**General Electric Co.**, Schenectady, N. Y. (8 pp., illustrated.) This booklet contains practical suggestions and basic rules on d.c. motor maintenance, including such subjects as selection of motor, inspection and servicing, overhauling and repairs and safety. A valuable feature of the publication is a trouble-correction chart, listing symptoms, causes and remedies.

★ ★ ★

PREVENTION OF TERMITE DAMAGE—**The Wood Preserving Corp.**, Koppers Bldg., Pittsburgh, Pa. (18 pp., illustrated.) Treatise on termite prevention and extermination compiled largely from publications and statements issued by United States Bureau of Entomology. Gives history and habitat of termite, methods of preventing termite attack, precautions to be taken in construction of new buildings, and eradication of termites in existing buildings. Final section deals with recommendations for use of pressure treated lumber for reconstruction of new buildings.

★ ★ ★

LARGE CAPACITY EXCAVATOR—**Harnischfeger Corp.**, Milwaukee, Wis. (30 pp., illustrated.) Bulletin X-21-1 describes P&H Model 955, which is available as 2½-yd. shovel, 3-yd. dragline, 3-yd. clamshell, or crawler crane. There is also long-range model capable of handling 3-yd. dragline bucket on 110-ft. boom, or 4-yd. clamshell bucket. This model is equipped with extra-long crawlers and wide shoes for maximum stability and low ground pressure. The new machine is built entirely of rolled high tensile steels, well-welded, and is diesel powered—with electricity as alternative equipment.

★ ★ ★

HOISTS, TROLLEYS, CRANES—**Wright Manufacturing Division**, American Chain & Cable Co., Inc., York, Pa. (99 pp., illustrated.) Revised edition of catalog covers hand-operated hoisting equipment, trolleys and cranes. Additions to line include floor type gantry crane, portable floor crane and new winch. Complete data are included on spur-gear, screw-gear and differential hoists, as well as considerable engineering data on cranes, trolleys and winches.



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HEAVY-DUTY INDUSTRIAL ENGINES—Cummins Engine Co., Columbus, Ind. (35 pp., illustrated.) Range of 4-, 6- and 12-cylinder models with maxi-



mum brake horsepower from 67 at 2,200 r.p.m. to 500 at 1,000 r.p.m. Curves show engine performance and fuel consumption at various speeds. Condensed specifications in tabulated form. Newest addition to line is supercharged, 6-cylinder model of 125 hp. at 2,200 r.p.m. Engine parts are described and illustrated. Suggestions on lubrication and fuel. Feature of Cummins diesel design is one valveless fuel pump that meters and delivers fuel to all cylinders and cam-actuated fuel injector.

★ ★ ★

EARTH-MOVING EQUIPMENT—R. G. LeTourneau, Inc., Peoria, Ill. (31 pp., illustrated.) Complete line of company's bulldozers, angledozers, rooters, carry-all scrapers, sheepsfoot rollers, pushdozers, treedozers, and tractor cranes. Written and prepared as though two men, an operator and an engineer or contractor, were discussing the features and advantages of the different tools. In addition, the operator and contractor visit the LeTourneau factory and see the construction and manufacture of the different machines and also learn about the Tournacar welding service.

★ ★ ★

REVOLVING CRANE—American Hoist & Derrick Co., St. Paul, Minn. (50 pp., illustrated.) Describes self-propelling traveling crane running on double-flanged track wheels or a traveling gantry of any desired practicable height. Also used with stationary tower mountings, barge mountings and skids. Powered by steam, gas or diesel engines or electric motors. For general construction work, handling bulk materials, around industrial plants and on dredge, dock and wharf work. Pictures illustrate a wide range of applications, with particular emphasis on building concrete dams. General specifications cover all parts of machine. Operation is by air-control system using knobs, instead of levers, that can be moved by finger tips. Sizes of construction units run from 60-ft. boom handling 30,000 lb. at 20-ft. radius to 125-ft. boom handling 100,000 lb. at 45-ft. radius.



★ ★ ★

BUCKETS FOR SINGLE DRUM HOISTS—Blaw-Knox Co., Pittsburgh, Pa. (40 pp., illustrated.) Types of buckets described under this user guide book include: (1) Single line hook-on clamshells for quick detaching and intermittent service, using single crane hook for operation; (2) single-line direct reeved type clamshells for permanent installations; (3) extremely low head room hook-on type clamshell buckets for quick detaching and intermittent service in handling sand, coal, coke and other loose or easy-to-dig materials where operating headroom is particularly limited; (4) single and two-line ship's tackle clamshells for unloading of granular bulk cargo from ocean vessels; (5) two-line hook-on type clamshells for quick detaching and intermittent service, using two crane hooks for operation; (6) dump buckets of tip-over type used whenever detachable hook-on type hand-dump and self-righting bucket is required; (7) bottom-dump buckets of controllable roller-gate type for easily controlled discharge, for example, of foundry sand through bottom-dump hook-on bucket; (8) Ingot tongs for handling upright ingots, either hot or cold—also tongs for special requirements.

★ ★ ★

ALL-WHEEL DRIVE—Marmion-Herrington Co., Inc., Indianapolis, Ind. (14 pp., illustrated.) Describes conversion of standard Ford motor vehicles to all-wheel drive, with energy of V-8 power plant distributed to four or six wheels instead of two, in order to produce added traction. Conversion involves substitution of new driving front axle for original front axle assembly, new two-speed auxiliary transmission or transfer case and changes in steering assembly. Table of specifications for various models.



PUMPED CONCRETE—Chain Belt Co., Milwaukee, Wis. (24 pp., illustrated.) Describes 1941 Rex Pumpcrete models which are now equipped with 3-way selective drive on double-cylinder units, enabling operator to pump through both cylinders simultaneously to gain full pumping capacity or to shut down either side of pump without interfering with continuous flow of concrete from other cylinder. On pours where two points are being placed simultaneously, 3-way selective drive allows operator to slow up flow of concrete in either pipe line to regulate rate of pour. New catalog includes information on pipe-line handling, informative data on types of jobs for which Pumpcrete is especially adapted and complete specifications and dimensions for machines themselves.



★ ★ ★

DIESEL TRUCK ENGINES—Cummins Engine Co., Columbus, Ind. (12 pp., illustrated.) Four-cycle units of 4 and 6 cylinders in power range from 66 to 200 hp. Details regarding fuel metering, distributing and injecting system. Electric starter. Detailed specifications in tabular form.

★ ★ ★

CREOSOTED WOOD CULVERTS—Koppers Co., Pittsburgh, Pa. (8 pp., illustrated.) Prefabricated culverts which can be erected by unskilled field labor and which withstand loads in excess of 20,000 lb. are described in booklet, "Pressure-Creosoted Laminex Culverts" (Form G-16). These culverts are made of laminated, pressure-creosoted wood, with sections interlocking cornerwise and lengthwise to form a solid, unified construction. Drawings and photos show how they are assembled. The booklet cites their advantages and use for railroads, highways, airport drainage, conduit for pipe lines, waste and storm sewers. A table lists sizes obtainable. Details of the lumber and preservative treatment used are given.

★ ★ ★

CONVEYOR BELT—B. F. Goodrich Co., Akron, Ohio. (10 pp., illustrated.) Text and pictures show construction details and varied types of operation of cord conveyor belt. Same principle of cord construction used in present-day automobile tires makes practical field splicing and vulcanizing. Booklet relates methods of manufacturing new type conveyor belt in non-technical language. Physical advantages of the cord belt construction are discussed in one chapter, while others take up the subjects of increased cover adhesion, flexibility, mildew resistance, freedom from stretch, vulcanized and metal splices, and engineering advantages. The method to be used in estimating the number of plies needed in the cord conveyor belt under different operating conditions is explained, as well as service conditions for which the belt is particularly adapted. Other pertinent points in conveyor belt operation are covered.



★ ★ ★

TWO-STAGE PUMPS—Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill. (6 pp., illustrated.) Line of two-stage, split-case pumps with capacities up to 550 g.p.m. at total dynamic heads ranging up to 600 ft. These units are suited to all classes of general pumping service where liquid is of low viscosity and free from foreign matter; they are used for water supply to high buildings, small municipalities, industrial and process plants, for boiler feed, hydraulic elevators, etc. Features which contribute to operating efficiency and long service life are: One-piece impellers of cast iron, hard bronze, or other alloy depending on requirements; "back to back" mounting on shaft to assure proper hydraulic balance; hand-finished interior surfaces; removable wearing rings with streamlined water guiding surfaces on both casing and impeller; shaft, of high manganese alloy steel, journaled in ball bearings of ample size to withstand all thrust and radial loads; centrifugally-cast bronze shaft sleeves mounted on shaft to protect it against abrasive or corrosive action of the liquid; horizontally divided bronze glands to facilitate removal and adjustment of packing; compact casing horizontally divided so that upper casing may be lifted to expose entire rotating element.

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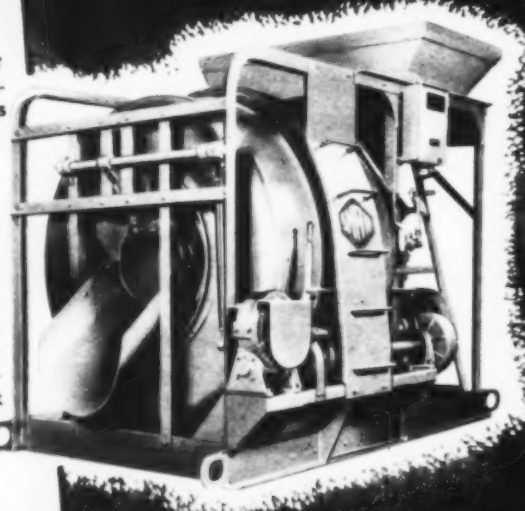
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LOADBINDERS	—	TROLLEYS	—	DIFFERENTIALS

"Dwarf" Piledrivers

(Continued from page 69)

parts) to its new manufacturing uses the first operation was the breaking up of the existing concrete floor, over most of an area of about 80,000 sq.ft. Laurance C. Roberts, Inc. performed this operation with a truck-mounted pavement breaker rig on which a Schramm gasoline-powered compressor supplied air to an impact tool on the rear end of the truck, illustrated herewith. The cylinder actuating the breaker tool, which is equipped with a 250-lb. striking head, has a 6-in. bore and a 4-ft. stroke. The machine delivers 15,000 ft.-lb. blows at the rate of about 60 per minute. Three of these machines completed the floor breaking job in 6 days.

Low-Head Pile Rigs

As the old concrete floor was removed a fleet of 5 special piledriving rigs started to work to provide support for the new floor. They had to be designed to clear the piping of the sprinkler system hung from the ceiling of the first story of the building which allowed a working clearance of only 9½ ft. Each rig, with leads 9 ft. 3 in. long, consisted essentially of a pair of A-frames of heavy timber, 10x10-in. pieces being used for the sills and 8x8's for the verticals and inclined braces, as illustrated. The piledriving rigs were moved from one setup to the next on rollers. From a sheave at the top of each rig was hung a No. 7 McKiernan-Terry double-acting pile hammer, weighing 5,000 lb. and working in vertical leads bolted to the timber frame. The movement of the hammer, which was operated by steam, was controlled by a cable from the single-drum of a LeRoi gasoline engine hoist. The pile hammer with an 800-lb. ram has a stroke of 9½ in., delivers up to 225 blows per minute and develops 4,150 ft.-lb. of energy per blow. Its overall length is 73 in.

On account of the low headroom which governed piledriving operations, the steel casings for the piles, 10¾-in. o.d. pipe had to be handled in 5- to 6-ft. lengths and jointed as driving progressed to depths of 25 to 32 ft. The first length of casing put down was equipped with a conical cast-steel driving shoe. Joints between successive pipe lengths were made with cast-steel sleeves designed with circular flanges for contact with abutting pipe ends and slightly tapered walls to insure a snug driving fit between pipe lengths. Each pile was driven to a penetration that would insure a load-carrying capacity of 20 tons. A total of 766 piles was driven in the 440x200-ft. ground floor area of the building.

Concrete Fill for Pile Casings

After driving was completed each steel casing was filled with a 1:2:4 mix of concrete. Delivered by trucks from a local ready-mix plant, the concrete first was discharged through one of the windows of the building into a large receiving hopper

and thence was moved to each newly driven pile in concrete buggies. From the buggies concrete was shoveled into the pile casings through a funnel-shaped hopper placed in their open ends.

The final operations consisted in cutting off at proper grade with an oxyacetylene torch the ends of the steel casings, capping the piles and pouring over them a new 8-in. thick reinforced floor.

Personnel

For Laurance C. Roberts, Inc., general contractor, Philip A. Hyatt, vice-president was project manager, J. K. Bell was field superintendent while E. M. Mahoney supervised piledriving operations for the MacArthur Concrete Pile Corp. The firm of Francisco & Jacobus, of New York City, were architects and engineers.

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Huge Canvas Tent

PROTECTS EARTH FILL

(Continued from page 70)

snow load. This is considered necessary because, while the tent itself weighs only 15 tons, if a snow load 1 ft. deep were to be accumulated over the entire area, the load carried by the cable system would be increased to 20 times the weight of the tent itself.

About 29,000 ft. of manila rope ranging from 1/2 in. to 2 1/2 in. in diameter are used on the job, together with 1,200 steel pulley blocks and 94,000 ft. of wire rope. In the entire assembly, there are 7,000 rope splices and on the 196x328-ft. canvas surface there are about 1,000 reef points. The canvas used is 10-oz. waterproof duck which comes to the tent maker's shop in strips 28 1/2 in. wide. There will be two open hatches in the tent, each 34x80 ft. in size, through which construction materials will be lowered or raised.

As the height of the dam increases, the area of canvas required will also have to be increased and, by reason of the irregularity in the canyon walls, its shape will have to be changed. This is provided for in the design, which imposes complex requirements on the tent maker because each of the strips of canvas that goes to make up the huge "top" is cut to an irregular pattern and additions likewise will be cut on a bias.

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(Continued from page 66)

program. The work is divided into divisions (usually 8 to 12 of these have been functioning at one time) each in charge of a superintendent directing perhaps eight crews, each consisting of 20 or more men. Each of these crews has a specialty and does nothing else. The crew that pours concrete footings is followed by those that place sills, creosoted posts and floor beams. Then come floor and wall crews followed by others for stairs, rafters, roofing and trim. As each crew finishes its specialty work on one building, it is transferred promptly to the next building in line with no lost time.

Under these methods a double row of buildings constituting the company street springs up in a few days with no confusion and a surprisingly small amount of waste material. A striking feature of the job is the cleanly appearance of the buildings during construction, which arises from the absence of scaffolding or falsework. To this feature is ascribed increased speed and safety with decreased cost. Scaffolding is made unnecessary by a plan in which work ordinarily done on the walls is here done on the flat. Entire sidewalls and ends of each building, one-story height at a time, are laid out on the sub-floors. Here all sills, studs and plates, as well as all diagonal bracing and headers for all openings are put together and spiked.

Then tongue-and-groove gypsum sheathing is laid down on the studs and nailed. Over this is placed a double-kraft, water-proofed building paper and, finally, outer tongue-and-groove 1-in. boards are placed and nailed. In the panels thus put together on the flat even the openings are marked and the sheathing is cut away to studs and headers with Skilsaws. The completed side (or end) panel is then raised to vertical position and braced. After this bracing and the succeeding plumbing of the panels, window and door frames can go in and, if the panel completes the wall height, rafters can then be handed up. After walls and ends are erected, practically nothing more has to be done on the outside of the building and thus the usual two-story staging is entirely unnecessary.

The bracketed "eye-brow" roofs that

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The remaining chapters explain and apply the theories involved in the design of the various structural elements, such as homogeneous beams of timber and steel, plate girders, reinforced concrete beams, tension and compression members in steel and timber trusses, columns of timber, steel, and reinforced concrete, members subjected to bending and axial stresses, and footings.

See what the book gives you:

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- chapter of classification and requirements of loads for various types of structures
- methods of computing deflections of beams and trusses
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project over the lower story (in the two-story buildings) are assembled before raising as part of the second floor wall panels so that when the walls are upright, the bracketed supports have been swung out exactly into place. For nailing these brackets to the walls, an outside working platform is needed somewhat above the lower floor level. This is the only outside staging required on the standard building; it is relatively simple to put up and is not high off the ground.

The absence of scaffolding is believed to have much to do with the fact that not a single serious accident has occurred in Fort Ord construction in a six-month period during which expenditures have been almost \$9,000,000 and a complete community for some 25,000 officers and enlisted men has been constructed.

Wall Panels Upended

There are some tricks, naturally, in up-ending these wall panels quickly and safely. For example, when the sills are laid down on the sub-floors, they are placed 4 in. inside the line marking the edge of the outer wall. Before raising the panels, 2x4-in. blocks are fastened down, with partially driven nails, on this 4-in. ledge outside the sills. These blocks are placed just outside window openings where they will be easily accessible from within after the panel is erect. Thus the wall panels are swung to upright position 4 in. inside their final location. When temporary braces have been put on and before the wall is finally trued up, these blocks are taken up and the wall panel is crowded out 4 in. with the aid of pinch-bars. This movement is simplified and safeguarded by "stops" or short pieces temporarily nailed in an upright position to the outside of the sheathing so that they limit the outward movement during the 4-in. shift and pending the spiking of the sills.

The building ends go up before the side-walls, always one story at a time. As the ends constitute relatively small sections, the carpenter crew can set them up without help. Temporary bracing for the ends is put on the outside to leave the floor area entirely clear for the two sidewall panels. All buildings are wide enough to allow both sidewalls to be laid out on the floor at the same time. When walls are ready for erection, a group of laborers from some nearby operation is called in to help and the men are stationed 4 to 6 ft. apart along the prone section. In this way walls as long as 150 ft. have been erected in one lift.

With a few temporary braces to hold the wall upright, the men then immediately turn to the other sidewall which is similarly set up. Then the extra help can be released, usually after being on the floor only a few minutes. After some experience it was found that the "eye-brow" projections could be made to fit at the building corners by making 45-deg. cuts on end and side extensions. This does away with special fitting on the outer walls.

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(Continued on page 122)

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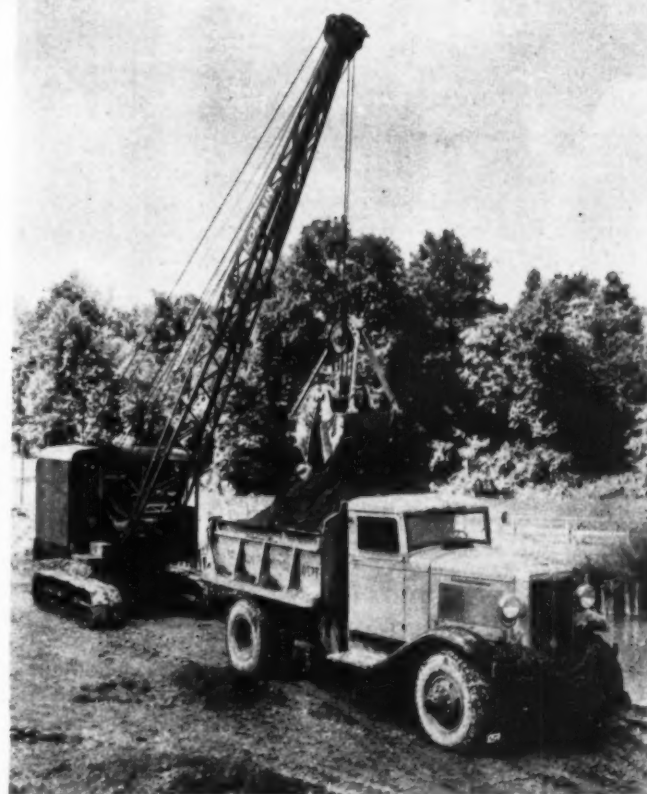
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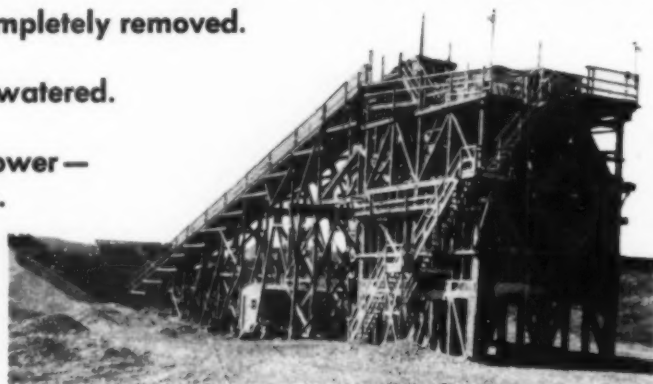
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Reliance offers a complete line of Rock Crushers; Bucket Elevators; Revolving Screens; Storage Bins; Pulverizers; Chip Spreaders; Heating Kettles; Bin Gates; Feeders; Belt Conveyors; Grizzlies; Air Separators; Sand and Gravel Spreaders; Wash Boxes.

(Continued from page 121)

responsibility, thus making the cantonment not one large job but an aggregate of many small jobs. Each division superintendent has an "expediter" whose function is to see that all needed deliveries of materials, supplies and equipment is timely and that no stoppage of the work results from this cause. The men that fill these jobs have to be alert, quick and of the "go-getter" type, accustomed to getting action promptly. They are given the necessary authority and motor-truck equipment to get special service in deliveries from mill, warehouse, or other sources of material.

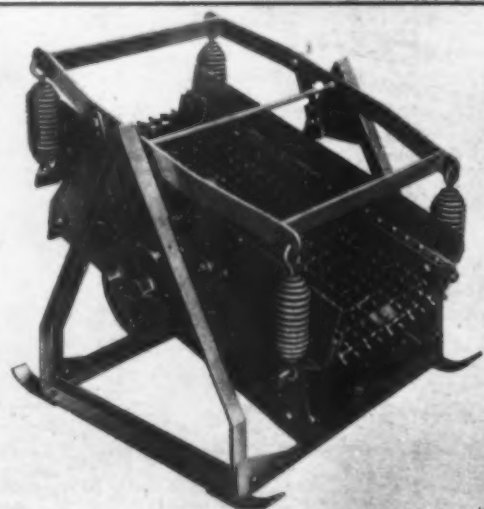


METAL SHIELDS TO STOP TERMITES cap concrete footings under creosoted posts.

At the height of the work about 2,700 men were employed. At the outset, almost one third the total number were carpenters. In the later stages plumbers, electricians and other crafts were required and the percentage of carpenters decreased. As a maximum the contractor had about 70 men on the job in engineering and supervisory capacities. They did all of the surveying, (only control lines had been run and main bench marks set before the contractors took over) checking, bookkeeping, ordering, etc. The freedom from necessity for clearances and approvals required under the cost-plus-a-fee plan is credited for much of the speedy action obtained in laying out and carrying on the construction plan.

Utilities and Paving

Water for the camp is obtained by pumping from wells and the supply is stored in eight 120,000-gal. wood-stave tanks set up on timber towers whence gravity develops a pressure of about 80 lb. per sq. in. over most of the camp. However, pumps can deliver directly to the mains in emergencies. Fire plugs are spaced 250 ft. apart. Sewage is collected in a 24-in. concrete interceptor leading to a modified Imhoff disposal plant whence effluent goes to the ocean. Each of the barracks has its own central heating plant using gas fuel (supplied by private utility at 11,500 B.t.u.) In the hospital unit of 100 buildings (including provision for



A PORTABLE VIBRATING SCREEN

Now used by Federal, State, County and City Highway Departments who appreciate the low maintenance cost of less than 3/4 of a cent per ton, including interest, power, screen cloth replacement and depreciation. Produces three accurate sizes of crushed stone, gravel, sand, coal, coke, cinders, etc. Light weight and low priced.

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● All Byers excavators are well known for their ability to get maximum yardage every day. With Byers shovels, it's the snappy, accurately controlled independent chain or cable crowd that does it. With Byers cranes it's their ability to swing while traveling.

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You can save hundreds of dollars ordinarily spent for single-purpose power tools, reduce idle tool-hour losses, cut maintenance costs and make more money with this Mall Portable Power Unit. It operates all day on 1½ to 2 gallons of gasoline and supplies low-cost driving power for 9 important interchangeable tools. It is easily wheeled right up to the job — is easy to start and runs by itself. Interchangeable attachments can be furnished for Concrete Vibrating, Concrete Surfacing, Form Sanding, Sawing, Sharp-ening Tools, Drilling, Grinding, Wire Brushing and Pumping.

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★★ We make over 200 gasoline engine, air and electrically operated tools and attachments.

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1757 SOUTH CHICAGO AVENUE CHICAGO, ILLINOIS

1,500 beds) a central plant provides steam heat.

Standard cantonment design is used. The 63-man two-story barrack with a 29½ x80-ft. floor plan is arranged along the standard company street which includes 3 barracks, one mess hall, one 25x45-ft. recreation building one company storehouse. At Fort Ord there are 398 of these



HEAVILY SCREENED WINDOW FRAME for warehouse is here being put together on jig. Note frame parts in shooks in background. Production rate is 200 frames per 8 hour per jig crew.

standard barracks. In addition to the standard units, Fort Ord has numerous special buildings including warehouses and four theatres each with a seating capacity of 1,038.

Initial grading, mostly in old beach sand, totaled about 2,000,000 cu. yd. Roads and truck parking areas (frequently used as parade grounds) were surfaced with some 300,000 sq. yd. of paving consisting of 5-in. compacted rock base overlaid with 2½ in. of graduated rock impregnated with asphalt.

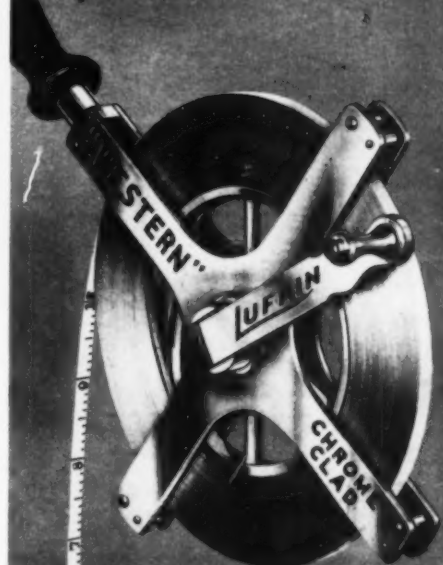
In the standard building area such concrete as was used went largely into the building foundations and the 2-in. concrete floors in kitchens, heater rooms and shower baths. The largest concrete order on the job was for 5,000 cu. yd. in 12 powder magazines along the shoreline built to the "igloo" design with arched roofs to be covered over with sand for bombproofing. These are 27 ft. wide and 40 or 60 ft. long.

Administration

Work at Fort Ord is under direction of the Quartermaster Corps, Col. H. D. Stetson, constructing quartermaster, and Capt. A. H. Griffin, engineer officer. For Ford J. Twaits-Morrison-Knudsen Co., Inc., the general contractors, R. M. Connor is project manager and Paul B. Tichenor is general superintendent. Most of the lumber came from the Daugherty Lumber Co., Cottage Grove, Ore. The 120,000-gal. wood-stave tanks were supplied by the Pacific Tank & Pipe Co. Some of the principal subcontractors are as follows: Sewers, Vinson & Pringle; heating, H. S. McClellan; plumbing, Anderson-Rowe Co.; electrical, Roy Butcher; painting, J. P. Carroll.

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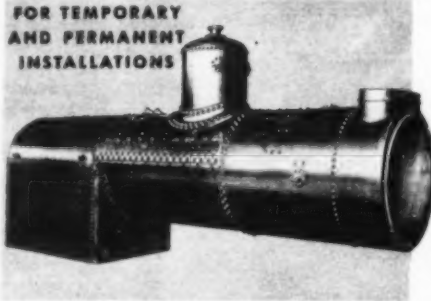
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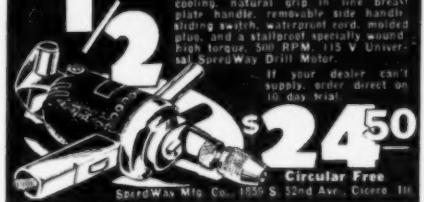
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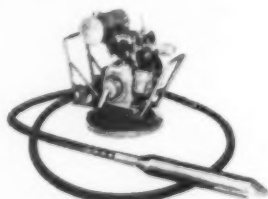
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foreman on earthmoving project or as executive assistant on building construction. Prefer Latin America but will consider offer elsewhere. References. American, 34, white. Available 30-60 days. PW 128. Construction Methods, 339 West 42nd St., New York, N. Y.

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20 and 30-yard Capacity All-Steel
Clark, Magor, Koppel and Western
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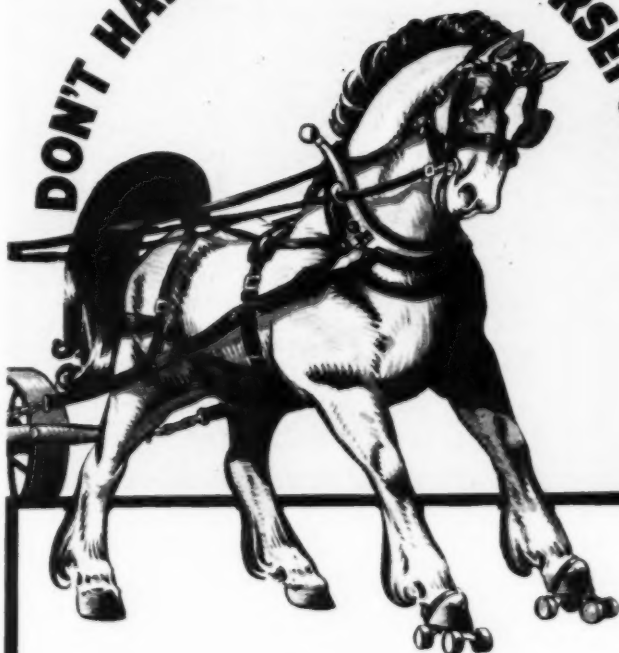
2—NEW Lorain 80, Diesel, 1-1/4 Yd. Capacity.
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DON'T HANDICAP YOUR HORSEPOWER



A motor grader without power on the front wheels is like a draft horse with roller skates on his front feet.

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Austin-Western



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FEWER CLIPS NEEDED. Here's another big saving. You use only three Laughlin Safety Clips to get the same strength you get with four ordinary U-Bolt Clips.

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Company.....

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ARMSTRONG



DROP FORGED WRENCHES

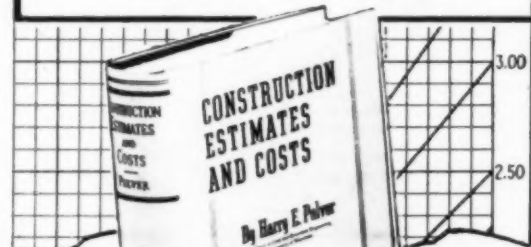


In construction work there's no telling what strain a wrench may be subjected to, that's where it pays to invest on ARMSTRONG Drop Forged Wrenches — the wrenches with a wide margin of extra strength.

Improved in design, drop forged from special carbon steels, heat treated, hardened, tempered to the correct point of stiffness and toughness, they make work easier, faster and safer. Over 100 types, including Carbon and Alloy Steel Construction and Structural Wrenches and Ratchets. Each type in all sizes.

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Takes up each step of construction work separately — from first investigation to final, detailed estimates — and provides simple, arithmetical methods of accurately estimating costs. Covers estimating with both tables and diagrams and includes specimen tables and diagrams. Both diagrams and tables show variations in quantities as well as in prices of material and labor. Worked-out estimates for typical jobs show application of methods.

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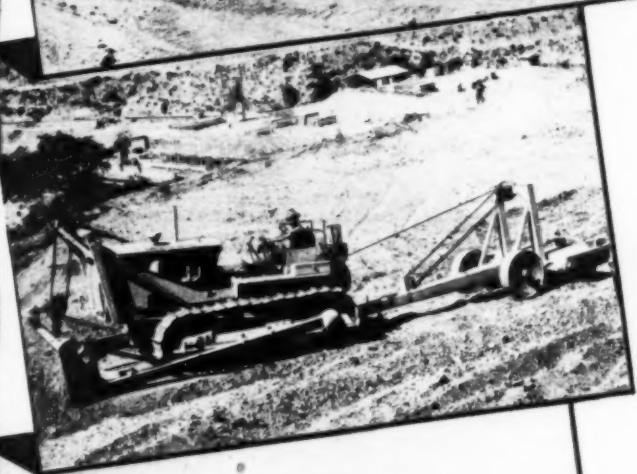
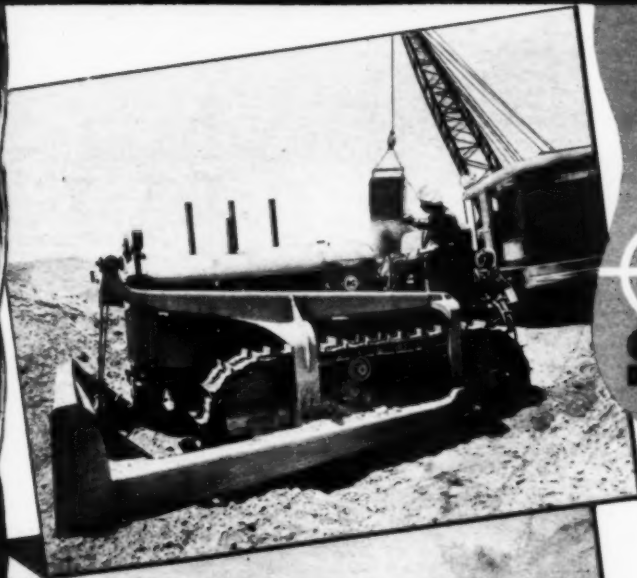
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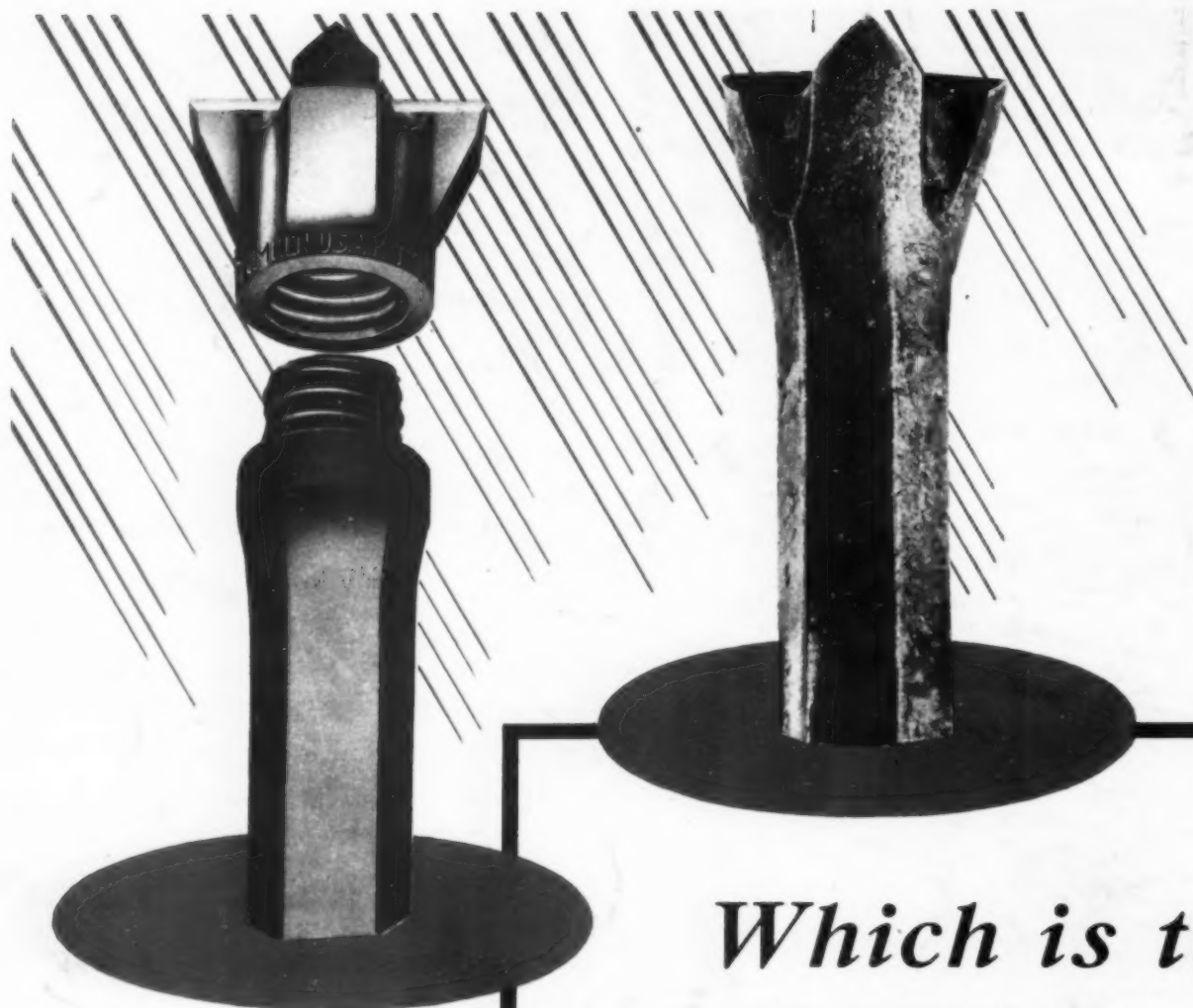
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Ten years ago there was but one tool in general use in the construction industry for drilling blast holes in rock—it was a bit forged as an integral part of a hollow drill steel rod. Later the TIMKEN Removable Rock Bit was offered to contractors. Radically different in design it had many time and cost saving advantages. Contractors, skeptical but anxious to reduce drilling costs, tried them out, liked them, bought more. In those early days the forged bit was called the "conventional" bit—and rightly so, for forged bit drilling was the "conventional" method.

Today, forged bits are still called "conventional". This is a hang-over. "Old-fashioned" is a more correct phrase, for TIMKEN Removable Bits have largely supplanted forged bits. In doing this the TIMKEN Bit became the conventional bit. Let's go conventional. Write for particulars.

TIMKEN
ROCK BITS

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO